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SCIENCE AND CITIZENSHIP*

THE fundamental principle of scientific work is unbending integrity of thought, following the evidence of fact, wherever it may lead, within the limits of experimental error and honest mistake. On this there can be no compromise; and since science is a universal interest of mankind, recognizing no barriers of race, class, religion or opinion (provided that is honest), a necessary condition of its advance and application is one of friendliness, frankness and equality. Goodwill and integrity, therefore, are indispensable alike to scientific progress itself and its successful employment for the benefit of mankind.

In this connection, the common phrase, "this scientific age" is all too apt to imply, with little justification, that the majority of people, at least in highly developed countries, now think and act scientifically; and, with no justification at all, to suggest that science can replace the older motives of human conduct. It is true that the external circumstances of life have been vastly altered by the applications of scientific discovery and invention, though as yet for only a minority of mankind. The future alone can decide whether natural resources and human ingenuity will prove sufficient, given statesmanship and goodwill, for the same transformation gradually to affect the whole of human society.

The development which has brought most vividly to the public conscience to-day the ethical problems aroused by the advance of scientific knowledge lies in the field of nuclear physics; and groups of scientific people in the free countries of the world are vigorously debating its various consequences, among them particularly the secrecy attached to weapons as devastating as those provided by nuclear fission. Atomic physics, however, is only one of many scientific developments which have brought, or are bringing, a mixture of possible good and evil about which judgments of relative value must be formed; we must not get too excited about one of them. There is no secrecy about most of these developments—they occur gradually and continuously before our eyes, and we tend to accept them without question as though they were natural phenomena; yet, in fact, the consequences of one of them provide the most solemn problem in the world. The dilemma is this. All the impulses of decent humanity, all the dictates of religion and all the traditions of medicine insist that suffering should be relieved, curable disease cured, preventable disease prevented. The obligation is regarded as unconditional: it is not permitted to argue that the suffering is due to folly, that the children are not wanted, that the patient's family would be happier if he died. All that may be so; but to accept it as a guide to action would lead to a degradation of standards of humanity by which civilization would be permanently and

* Abstract of the Presidential Address of Prof. A. V. Hill, F.R.S., to the British Association, 1952.

indefinitely poorer. Conduct usually falls short of principle; but that would be the worst reason for abandoning principles altogether.

In many parts of the world, advances of public health, improved sanitation, the avoidance of epidemics, the fighting of insect-borne disease, the lowering of infantile death rates and a prolongation of the span of life have led to a vast increase of population. Not only is the population increasing, but also in many places its rate of increase is still rising; and these processes will take so long to reverse that for many years to come the shortage of natural resources, particularly of food, is bound to provide increasing deprivation and disturbance.

Referring to India, nobody would dare to say that steps to combat diseases, such as tuberculosis and cholera, to improve rural and industrial health, to increase the supply of drugs and medical equipment and services, should not be taken on the highest priority; but the consequence must be faced that a further increase of a million people a year would result. Thus, science, biological, medical, chemical and engineering, applied for motives of decent humanity entirely beyond reproach, with no objectionable secrecy, has led to a problem of the utmost public gravity which will require all the resources of science, humanity and statesmanship for its solution.

The example of India has been taken because of the sheer magnitude of the problem and because its seriousness is now admitted by humane and responsible men; but the same conditions exist already in many parts of the world and will soon exist elsewhere. It is *not* a question only of food; if a higher standard of life is to become universal, with education, communications, housing, reasonable amenities and public health, a far greater demand will be made on all such natural resources as power, chemicals, minerals, metals, water and wood. One is left wondering how long these can possibly take the strain. Could world supplies conceivably hold out if the present requirement per head in the United States were multiplied in proportion to meet the same demand everywhere—even without any increase of present population; and if so, for how long? There is much discussion of human rights. At what level can these be reasonably pitched? And do they extend to unlimited reproduction, with a consequent obligation falling on those more careful? These problems must be faced not only with goodwill and humanity but also with integrity and courage, not refusing to recognize the compulsion of simple arithmetic.

Co-operation is required, not conflict; for science can be used to express and apply the principles of ethics, and those principles themselves can guide the behaviour of scientific men; while the appreciation of what is good and beautiful can provide to both a vision of encouragement.

It is true that scientific research has opened up the possibility of unprecedented good, or unlimited harm, for mankind; but the use that is made of it depends in the end on the moral judgments of the whole community of men. It is totally impossible now to reverse the process of discovery; it will certainly go on. To help to guide its use aright is not a scientific dilemma, but the honourable and compelling duty of a good citizen.

SECOND INTERNATIONAL CONGRESS ON RHEOLOGY

THE British Society of Rheology, supported by the Joint Commission on Rheology of the International Council of Scientific Unions, is arranging to hold the Second International Congress on Rheology at St. Hilda's College, Oxford, England, from July 26 to July 31, 1953.

The Congress will cover the whole field of the study of the deformation and flow of matter, except such specialized subjects as have come to be regarded as branches of applied mechanics, *e.g.*, the classical theory of elasticity, aerodynamics.

Papers which must not exceed 2,000 words in length (including space for figures) will be accepted subject to referee's approval and should reach the Organizing Secretary, Dr. G. W. Scott Blair, The University, Reading, England, by December 1, 1952. The Proceedings will be published in book form, and, since it is intended to circulate proofs of the papers at the Congress itself contributions cannot be guaranteed inclusion in the Proceedings, if received late.

Arrangements will be made for excursions, visits to Colleges, etc., during the Congress. The wives of rheologists are welcome. The fee for the Congress, including available pre-prints, and a copy of the final Proceedings, is expected to be about £ 4, payable before May 1, 1953.

NUFFIELD FOUNDATION TRAVELLING FELLOWSHIP AWARDS FOR 1953-54

THE Nuffield Foundation, with the object of advancing the interests of India as a whole and further strengthening the academic ties between India and the United Kingdom, has decided to make available to India five Travelling Fellowships for the year 1951-52. An Advisory Committee in India has been appointed by the Foundation to advise them on the administration of the scheme, consisting of Shri V. T. Krishnamachari, Member, Planning Commission (Chairman), Shri S. Varadachariar, Dr. C. V. Raman and Shri J. J. Ghandy. It has been decided to award the Fellowships for the year 1953-54 in the following subjects :

Two Fellowships in Medicinal Sciences, preference being given to candidates wishing to study (1) Pathology, and (2) Bacteriology;

One Fellowship in Engineering, preference being given to candidates wishing to study Mining Engineering or Chemical Engineering;

One Fellowship in Natural Sciences, preference being given to candidates wishing to study Animal Husbandry ; and

One Fellowship in Social Sciences, preference being given to candidates wishing to specialise in the Statistical Study of the Population Problem in India with particular reference to the Food Supply.

The Fellowships are intended for men or women of first-rate intellectual and personal qualities, who have already shown unusual capacity to advance knowledge and teaching in one of the fields concerned. Candidates must be Indian nationals, normally between the ages of 25 and 40 years, and must be University Graduates holding, preferably, a Master's or Doctor's Degree, and having subsequently had a year or more of teaching or research experience on the staff of a University or comparable institution. It is estimated that the total value of an award (exclusive of travelling expenses) will be at the rate of from £770 to £890 a year (sterling), according to individual circumstances.

The Fellowship will be awarded by the Trustees of the Foundation on the recommendation of its Advisory Committee in India. Applications for Fellowships for 1953-54 (one original and three copies) should be submitted not later than 15th January, 1953, to the Secretary, Nuffield Foundation Indian Advisory Committee, Planning Commission, Rashtrapati Bhawan, New Delhi, from whom copies of the form of application may be obtained.

INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE

THE Indian National Scientific Documentation Centre, recently set up in New Delhi by the Government of India, under the auspices of the Council of Scientific and Industrial Research with assistance from the UNESCO has started active work already.

The most important function of the Centre is to receive and retain all scientific periodicals required in India, to supply photographic copies, translations and abstracts of articles required by laboratories or individual workers, and to be a national repository for reports of the scientific work of the nation. It is also intended that through this Centre the scientific work of India will be made known and made available to the rest of the world.

As a basis for the operation of the Centre a large number of journals, especially those dealing with the physical sciences, have been ordered and are being received regularly. In addition, nearly 12,000 books are also available for reference in the N.P.L. Library. With these journals and by borrowing other journals and books available in the Delhi area, INSDOC is able to attend expeditiously to enquiries for bibliographies on specific subjects or to supply a photographic copy on paper or microfilm of most scientific papers. The Centre will also, if necessary, obtain copies of articles from abroad if the journals in question are not available in India. Translations into English are made from German, French, Russian, Czech, Italian, Spanish, Portuguese, Dutch, Danish, Norwegian and Swedish.

The INSDOC Documentation Centre levies small charges for making available its services to scientific institutions and research workers. The charges are lower than those levied by the documentation centres abroad. The object is that the services of the INSDOC should be availed of by as many scientific workers as possible. Some microfilm readers supplied by UNESCO are also available with the Centre. These are rented out to scientific institutions, universities, etc., both in Delhi and in other regions of India.

A STUDY OF SOME PALAEOLITHIC ARTIFACTS FROM SOUTH INDIA

MRS. B. ALLCHIN

(Institute of Archæology, London University)

THE specimens described in this paper are from the collections preserved in the Geology Department, Central College, Bangalore, consisting of (*a*) artifacts collected by Professor L. Rama Rao and his assistants at Velaungudi, Trichinopoly Dist.; (*b*) artifacts collected by the late Professor P. Sampat Iyengar near Kibbanhalli in Tiptur Taluk, Mysore State; and (*c*) a number of small groups of artifacts from various other sites mainly in Mysore and Madras. I have made a detailed study of the two larger groups only, as there did not seem to be sufficient examples in the other groups to indicate the range of tool types. On the whole, however, the typology of the smaller groups appears to follow that of the larger very closely.

Professor P. Sampat Iyengar published an account of the finds from Kibbanhalli site together with a description of the site in a paper read before the Geological Section of the Indian Science Congress in 1924, entitled "A Palæolithic Settlement and Factory in Mysore State". He divides implements of various degrees of skill of manufacture into Eoliths, Palæoliths, and Neoliths, and considers that the site was occupied continuously during all these phases. In the light of more recent discoveries, however, it appears unlikely that this is the case, as it would mean continuous occupation for tens of thousands of years. He also mentions that he found no actual sites of habitation. It seems more probable, therefore, that this is simply a palæolithic factory site similar to those found in Africa. These sites are strewn with artifacts in varying stages of completion which have been for some reason—such as unsuitability of stone—discarded by the makers, hence the 'Eoliths'. I could not see any implements in the collection which could be classed as true Neoliths.

Two papers by K. Sripada Rao describing in all eleven implements from the Central College collection in great detail appeared in the *Journal of the Mysore University.** The author includes suggestions on how the implements may have been hafted.

The artifacts from both Kibbanhalli and Velaungudi closely resemble those found in other parts of India. Those in the Kibbanhalli collection particularly, resemble specimens found by Bruce Foote at Attirampakkam in the Chingleput District of Madras, and other sites in Madras State, nearly all of which are made from the same material, quartzite. The Trichinopoly artifacts are made largely from chert, and have certain slight differences which can be seen in the photographs, as chert has a much finer cleavage than quartzite. Both groups, however, show the same general forms and technique of manufacture. The quartzite artifacts are very similar to tools found in large numbers in South Africa.

Some of the forms found at these sites have an almost world-wide distribution. The hand axe occurs from South Africa to North-West Europe and to South-East Asia. The cleaver also occurs in all these areas, but in relatively smaller numbers in Europe in proportion to the number of hand axes.

I have classified the artifacts according to the terminology most widely used today, but I have not given detailed description of the form and manufacture of the types mentioned as this has been very fully done by a number of authorities, perhaps most recently and clearly by Kenneth P. Oakley in "Man the Toolmaker", published by the British Museum (Natural History Section). For those types with which Oakley has not dealt, I have given notes or other references.

The following list includes all the tools of the two groups:

Kibbanhalli Tool Types (all quartzite except where stated)

Cleavers.—18 (11 on cores, 7 on flakes, 1 broken specimen of quartz).

Hand axes.—52 (28 on cores, varying from 2"-9" in length, 5 of the smallest being of quartz).

Rostro-carinates.—10 (1 of quartz).

Discs.—34 (22 on cores, 12 on flakes. 1 is of dolerite. There is a great variety of size and thickness, grading into the chopper-tools).

Chopper-tools.—43 (All on flakes, which are mostly of large rough clactonian type).

Concave (Hollow) Scrapers.—16 (all on medium-sized coarse flakes; they include 1 with two concave cutting edges, and also 2 considerably smaller specimens one of quartz and one of agate).

Small Core Scrapers.—3.

Blade Cores.—8 (one chert and one chalcedony).

* July 1930, **4**, No. 2, and January 1932, **6**, No. 1.

Small Flakes.—34 (all showing signs of use as points scrapers, etc., 7 of quartz).

Digging Tools (?).—2.

Fabricators (?).—3.

Borers.—20 (4 on cores, 16 on flakes. 2 quartz, great variety from long points and concave sides—most extreme on flakes, to small rostro-carinate like specimens—most extreme on cores).

Velaungudi Tool Types (all chert except where stated)

Cleavers.—4 (all on flakes, one granite).

Hand axes.—23 (9 on cores, including 3 very small, and 2 large almost rostro-carinate in form. 14 on flakes, 8 very small, i.e., under 1½" and 6 1½"-3").

Discs.—3 (on cores).

Chopper Tools.—25 (3 on cores, remainder flakes).

Hollow Scrapers.—18 (all on flakes varying greatly in size).

Square Scrapers.—5 (all with straight cutting edge).

Flakes.—41 (all showing signs on use as points and scrapers).

Fabricators (?).—3.

Borers.—7 (all on flakes except one, 3 being extremely large and crude).

It will be seen that the divisions in these lists are somewhat arbitrary; in reality the various tool types grade into one another almost imperceptibly, and it is often very difficult to decide where to draw the line. In the photographs the tools are arranged in series so as to illustrate this.

Plate I shows cleavers and hand axes. 1-8 are reasonably well finished and show the cleaver in process of transformation into the hand axe. 9-11 are much cruder, 9 showing only doubtful signs of human workmanship. 10 and 11 it will be seen bear considerable resemblance to No. 6 in Plate II.

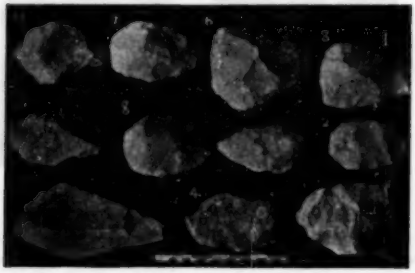

PLATE I. From Kibbanhalli, Tiptur Taluk. 1-3. Cleavers on cores. 4. Cleaver on flake (flake surface uppermost). 5. Hand axe on flake (flake surface uppermost). 6-7. Hand axes on cores. 8. Hand axe on pebble. 9. Rostro-carinate. 10. Hand axe (?) on thin slab of rock. 11. Hand axe-borer on flake.

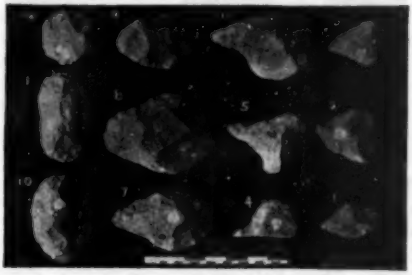

PLATE II. From Kibbanhalli, Tiptur Taluk. 1-5. Borers on flakes and cores (the point of 2 having been broken in use). 6. Hand axe-borer on core 7. Hand axe on core. 8. Hand axe-cleaver on core. 9. Hand axe-disc on core. 10-11. Discs on cores. 12. Disc on flake.

Plate II shows an even more extensive series: a disc on a flake which might almost be classified as a chopper tool; two oval shapes classed as discs, on cores; one artifact representing the half-way stage between disc and cleaver but classed as cleaver; one hand axe with a tendency to concave sides, and leading on from this a series of diminishing borers.*

Plate III presents three particularly interesting specimens (1, 4 and 5). They appear to be blade cores from which long narrow blades have been struck, as opposed to flakes like those in Plate IV. No blades are to be found in Professor Iyengar's collection; so presumably they were either overlooked at the site, or taken away by the makers and lost. These cores are very similar in form, and differ only in size from microlithic blade cores found all over India. This plate also includes two curious long curved tools Nos. 2 and 3 (those classed by Professor Iyengar as neolithic). The curved shape appears to me to be due to some peculiar line of cleavage in the rock. Judging by the use marks on the pointed ends they were used as digging tools. Finally 6 and 7 I have classed as fabri-

* *The Borer.*—I have used this term to describe a tool which resembles a small hand axe with concave sides and a point sometimes exceedingly long and sharp, and bearing use marks on the point in most cases. This type seems to be peculiar to South India.

PLATE III. From Kibbanhalli, Tiptur Taluk. 1, 4 and 5 are blade cores (blade scars indicated). 2-3. Curved digging tools (?). 6-7. Fabricators (?).

cators. They both show considerable signs of battering against hard objects at either end, and possibly were used in the manufacture of other artifacts.†

Plate IV shows two concave-sided points on flakes (1 and 2) which can be classed as borers, three small flakes showing signs of use one as a point and two as side scrapers (3-5), and three large concave scrapers on coarse flakes,

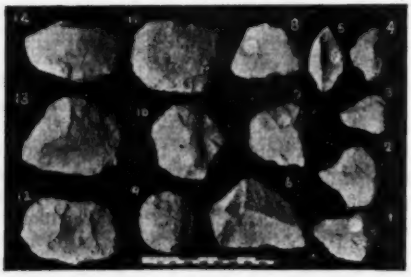

PLATE IV. From Kibbanhalli, Tiptur Taluk. 1-2. Concave sided points on flakes. 3. Flake (showing signs of use on point). 4-5. Flakes (showing signs of use as side scrapers). 6-8. Concave scrapers. 9. Disc on core. 10-11. Discs on flakes. 12-14. Chopping tools on coarse flakes.

the central one having two notches in the cutting edge and the others one each. Finally two discs on flakes (10 and 11), and four on cores (9, 12-14).

† Tools of this nature are described by L. S. B. Leakey in various accounts of the archæology of East Africa.

Plate V shows a series of hand axes from the Trichinopoly site, including the two peculiarly elongated specimens mentioned in the list above, which, like No. 9 in Plate I, appear to be partly finished hand axes abandoned before completion.

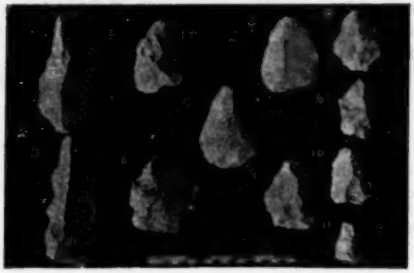

PLATE V. From Velaungudi, Trichinopoly. 1-11 Series of hand axes.

I have included a number of very small artifacts under the heading hand axes, simply because the only way in which they differ from the larger specimens is in size. It is, therefore, quite impossible to make any clear division into two classes, although the smaller ones might be better described as points.

Plate VI shows three large chopping tools, 1 and 3 on flakes, and 2 on a core. 4-7 belong to a class of scrapers on flakes peculiar to this group of tools: they are roughly square, thin

PLATE VI. From Velaungudi, Trichinopoly. 1 and 3. Chopping tools on flakes. 2. Chopping tool on core. 4-7. Square scrapers on flakes. 8-10. Cleavers on flakes. 11. Disc-cleaver on flake.

flakes with an almost straight cutting edge. 8-10 are all cleavers on flakes—the difference between 8 and 4-7 not being a great one. 12 is a disc-like cleaver on a flake.

Plate VII shows one possible fabricator (2). Although in form it is rather different from those from Kibbanhalli it has very similar battering on both ends. 1 and 3-7 are hollow scrapers on flakes. The flakes vary greatly in size

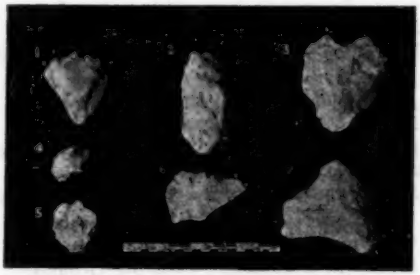

PLATE VII. From Velaungudi, Trichinopoly. 2. Fabricator (?). 1 and 3-7. Hollow Scrapers on flakes.

as do the hollow scraped edges. Several, it will be seen, have two hollows and a kind of 'beak' between them.

The difference in size of artifacts from the two sites is due to the fact that the chert in the Velaungudi area occurs only in nodules of limited size, whereas quartzite can be obtained at Kibbanhalli in lumps of almost any size from outcrops at the site. Also the finer cleavage of chert allows for much finer flaking, and this fact makes possible the manufacture of the square scrapers with straight cutting edges mentioned above. In both cases the artifacts were found at the places where the raw material used occurs. Palæolithic man in this part of the world, like his relations in South Africa appears to have come to the place where suitable stone was to be found, and made his tools there. In this way he differs from the Neolithic inhabitants of the Deccan who often brought their raw materials for the manufacture of 'celts' and microliths considerable distances, sometimes many miles, to their homes, and made the tools there. This difference appears to be due to two causes. In the first place it is probable that palæolithic man had no permanent home. Where caves occur he no doubt occupied them, as in other parts of the world. But even this was probably only at certain seasons of the year. Like the South African bushman of today, he was in all probability a wanderer. Small groups followed the herds of game in their seasonal migrations, sleeping in the open, or building temporary shelters of sticks or leaves. But like the animals they hunted, they wandered within limits, returning to certain places at approximately the same time every year. In this way it seems probable that the same group returned regularly to their factory sites, and made a supply of artifacts, which they took away with them, leaving behind waste material and imperfect or incomplete specimens. Another reason why they made the artifacts on the spot is that their method of working entailed a large amount of waste, therefore, they would have had to carry away an enormous weight of unwanted stone. This again was different in the case of neolithic man who was far more economical in the use of raw materials.

In conclusion I would like to extend my sincere thanks to Professor L. Rama Rao for putting the material at my disposal and for his kindly advice and aid, without which this study would not have been written. I should also like to thank the members of the staff of the Geology Department, Central College; and my husband who has helped me in many ways.

JOURNAL OF THE BOMBAY NATURAL HISTORY SOCIETY

THE Bombay Natural History Society Journal, which has maintained uninterrupted publication for the last 66 years, completed its fiftieth volume with the present issue. This surely is an occasion for justifiable pride. From small beginnings—four parts of Vol. I published in 1886 contained only 234 pages—it has grown to imposing proportions, the average number of pages in the last 10 volumes being 774. For a natural history publication conducted by a private society purely out of revenues derived from its membership subscriptions, with practically no financial aid from Government or extraneous sources, this is indeed a praiseworthy achievement.

We extend to the Journal our heartiest good wishes for a future even more splendid than the past.

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ON CLOSED PROTON SHELLS IN NUCLEI OF ATOMIC NUMBER LESS THAN FIFTY

Recently the single particle model[1–5] has come into much prominence. Many nuclear properties are fairly well explained according to this scheme. The most important basis for the model, however, is the occurrence of magic numbers whose existence now seems to be well established. That neutron or proton numbers 2, 8, 50, 82 and neutron number 126 give particularly stable structure, can now be affirmed with a good amount of certainty.[6] All the different nuclear models are also formulated in a way so that they give closed shells at these numbers. But theory predicts the occurrence of a number of other shells or subshells at different magic numbers. Empirical evidence also shows greater or smaller stability at neutron or proton numbers 20, 28 and proton numbers 14 and 58.[7,8] Though there is some doubt as to the particular stability at 20[9] and the evidence for 14 and 28[10] is not very convincing, yet it is highly probable that these numbers must be representing the closing of at least some subshells. Recent investigation of Stähelin and Preiswerk[11] gives in addition to the numbers already mentioned 38, 64 and 92 as possible magic numbers. Duckworth and Preston[12] give some evidence to show probable magic characteristic of neutron numbers 16, 32 and 70 and proton number 40. From a study of α-ray systematics Sengupta[13] concludes the existence of proton subshells at $Z = 88$ and 92.

It was noted by Elsasser[14] that the distribution of the number of stable isotopes for even atomic numbers shows a periodic variation

with Z. Since his work, several new isotopes have been discovered and it is worthwhile to re-examine the variation, especially because we can get some idea regarding the stable proton shells from a study of this curve. In Fig. 1 number of stable nuclei

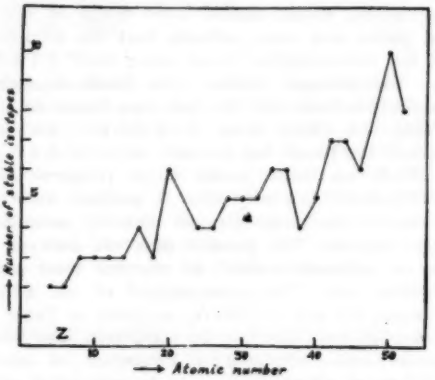

FIG. 1. Variation of the no. of stable nuclei with Z.

is plotted against even Z for $Z \leqslant 50$. Data are taken from Rosenfeld.[15] The well-known fact that the number of stable isotopes increases with Z, can be easily noticed. There are however sharp fluctuations superposed over this general trend. At $Z = 16$, 20 and 50 we get peaks and at $Z = 8$, 28, 34 and 42 we have a sudden increase in the number of stable isotopes. This evidently signifies some stability of nuclei with the particular number of protons.

As already pointed out, both theoretical and empirical evidence for closed shells at 8, 20, 28 and 50 are well-known. According to Mayer's scheme[1] both 16 and 34 should also be magic numbers owing to the filling up of $2s_{1/2}$ and $1f_{5/2}$ levels. Stability of proton number 16 may also be deduced from Fig. 2, where energy release for the addition of an odd proton to an even Z nucleus is plotted against Z, for nuclei with neutron excess 2. Data have been taken from Rosenfeld.[15] From the figure, distinct minima are noted at $Z = 2$, 8 and 16. The apparent stability of $Z = 42$ should perhaps be ascribed to the completion of the subshell $2p_{1/2}$ at $Z = 40$, for which some stability has been observed by Duckworth and Preston.

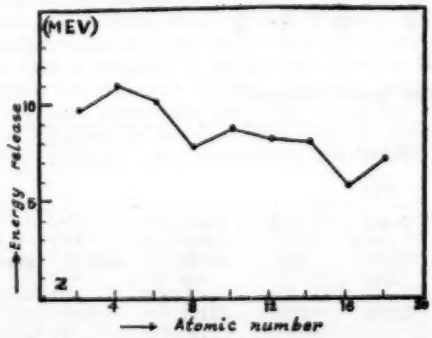

FIG. 2. Energy release for the addition of on odd proton to an even Z nucleus shown against Z.

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Krishnagar,
W. Bengal,
July 23, 1952.

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THE BLUE BANDS OF BENZALDEHYDE

BANDS similar in appearance and wave-lengths, to those recorded by Stewart and others[1] have been obtained in the spectrum of a suitably controlled transformer discharge through flowing benzaldehyde vapour. The typical spectrogram reproduced here was taken on a glass three-prism Steinheil spectrograph with its large aperture camera (f/2·8) on a Kodak P.1200 plate with 5 hours exposure to a transformer discharge through flowing vapour of benzaldehyde. The flow of the vapour and the voltage of the transformer were adjusted such that the glow obtained was always maintained at a faint bluish colour.

Most of the bands are broad and diffuse but a few of them show a clear degradation towards the longer waves marked R in Table 1 and occur with an intensity comparable with that of the Angstrom bands which are also present on the plate. There are a few narrow bands on the extreme long wave-length side of the plate which are also degraded towards the red and which from their structure appear to belong to a different system and probably to a different emitter (CN?).

TABLE 1

λ air	Int.	Description	ν vac.	Stewart[1] $\nu \times 10^{-4}$
(3940)	0	Broad, diffuse	(25374)	2538
3971·2R	5	Broad	25174	2516
4011·9R	1	Broad	24919	2494
(4247)	0	Narrow, diffuse	(23539)	2364
4266·5R*	10	Broad	23432	2344
4313·1	2	Broad, diffuse	23179	..
4380·2	2	do	22834	2299
(4587)R	0	Narrow	(21795)	2179
4601·4R†	8	Sharp	21726	2169
4659·7	2	Broad, diffuse	21455	2151
4719·8	1	do	21181	2123
(4958)	0	Diffuse	(20164)	..
4986·7R	5	Sharp	20048	2014
5046·8	2	Broad, diffuse	19809	..
5442·5	3	Diffuse	18369	..

* High dispersion plates show that this consists of two heads with λλ4262·9 and 4268·3 which is again a very close doublet.

† Similar remarks as for band at λ4266·5. The band consists of two heads with λλ4598·1 and 4603·0.

Higher dispersion plates (camera lens f = 640 mm. and aperture f/9·1) show that the bands at 4265·2 and 4601·4 A, are double-headed, each head again being a very close doublet. These and other features are indicated in Table I which gives the band head data obtained in the present experiments. In view of the character of the bands, measurements were made on several plates and these indicate that the accuracy of the wave-lengths is not more than ± 1 A.U. for the stronger bands. For bands included in the brackets and the last two bands in the Table, the likely error is ± 4 A.U. For the rest of the bands the probable error is ± 2 A.U.

Work on these bands is in progress and T. Pradhan[2] has been able to produce them in a spark discharge through flowing benzaldehyde vapour. The present data are deemed to be of sufficient interest to warrant their publication now. The arrangement of the bands (except the one at 3940 A) as given in Table II indicates that they can be comprised into three series each involving a frequency of about 1740 cm.$^{-1}$ which appears to be associated with the lower state involved in these bands. This is close to one of the fundamental vibrational frequencies of the benzaldehyde molecule as obtained in infra-red[3] (1724 cm.$^{-1}$) and Raman[4]

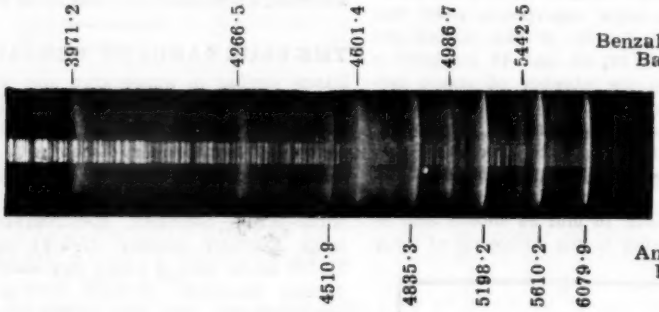

TABLE II

Series arrangement of the wave numbers

I	..	(23539)	*1744*	(21795)	*1731*	(20164)				
		..		..		..				
		1380		*1384*		*1391*				
II	..	24919	*1735*	23179	*1724*	21455	*1646*	19809		
		(*255*)		(*253*)		(*271*)		(*239*)		
		25174	*1742*	23432	*1706*	21726	*1678*	20048	*1679*	1836
						1369		*1372*		
III	..					22824	*1643*	21181		
						..		..		

(1701 cm.$^{-1}$) data and forms evidence to show that the bands are probably due to benzaldehyde.

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July 16, 1952.

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GYPSUM DEPOSIT OF GARUR CHATTI, GARHWAL, U. P.

THE existence of gypsum in the district of Tehri Garhwal has been reported by Auden,[1] G. N. Dutt[2] and others. But the deposit of gypsum on the south bank of the river Ganges, near Garur Chatti (78° 20′ E/30° 6′ N, formerly within British Garhwal), with good potentialities has so far failed to receive any serious consideration.

Massive irregular pockets of gypsum, interbedded with dolomite or dolomitic limestone of the Krol series (trending NW-SE) are located to the south of Garur Chatti, in an area between 78° 18′ E/78° 21′ E and 30° 6′ N/30° 8′ N. Deposits are broadly divided into three groups, (*a*) stratified, (*b*) irregular pockets, (*c*) floats. Some of these are well stratified and suggest a considerable degree of replacement of the original bedded sediment. Small-scale displacement is a common feature. The thickness of the deposit varies between 200 ft. and 5 ft. in general and it extends in strike-wise direction for 5,000 ft. in detached lengths. Isolated pockets of variable dimensions are often connected by thin innumerable stringers and veins of snow-white gypsum. The mineral in the stratified deposit is found to have light greenish white, milk-white, buff or grayish brown colour. The snow-white variety (98-99% $CaSO_4$, $2H_2O$) is of minor occurrence. The light greenish or grayish white variety with good reserve deserves closer consideration. Medium to coarse-grained white crystalline varieties are occasionally present in isolated patches. Chief tectonic impurities[3] associated with them are dolomitic limestone, alumina, iron oxide and silica. Surface deposits or floats are irregularly strewn over hill slopes.

Considerable degree of replacement under static condition helped in concentrating the gypsum in isolated pockets. The structure and composition of the bed rock are highly variable. These together with pH and Eh value and temperature of the lime sulphate solution were few of the important factors controlling the shape, dimension and quality of the deposit.

A rough estimate of the total reserve is 105,000 tons. The deposit is a very promising one and further work of exploration should be seriously taken into consideration. The greatest obstacle in developing the property is, however, the matter of transport and accessibility of the area under consideration.

Gauhati University, ANIL KRISHNA BANERJEE.
Assam,
August 8, 1952.

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CALCULATION OF ELECTRONIC ENERGY LEVELS OF INDENE

ENERGY levels for Indene molecule containing a six and five-membered ring have been calculated adopting Sklar's valence Bond method.[1] Assuming seven canonical structures, the following secular determinant has been obtained:

$$\begin{vmatrix} x+5a/2 & x/4+7a/4 & x/2+2a & x/2+2a & x/2+2a & x/2+5a/4 & x/4+a \\ x/4+7a/4 & x+5a/2 & x/2+2a & x/2+2a & x/2+2a & x/8+7a/8 & x/4+a \\ x/2+2a & x/2+2a & x+a & x/4+7a/4 & x/4+7a/4 & x/4+a & x/2+a/2 \\ x/2+2a & x/2+2a & x/4+7a/4 & x+a & x/4+7a/4 & x/4+a & x/8+7a/8 \\ x/2+2a & x/2+2a & x/4+7a/4 & x/4+7a/4 & x+a & x/4+a & x/8+7a/8 \\ x/2+5a/4 & x/2+7a/8 & x/4+a & x/4+a & x/4+a & x-a/2 & x/2+a/2 \\ x/4+a & x/4+a & x/2+a/2 & x/8+7a/8 & x/8+7a/8 & x/2+a/2 & x-2a \end{vmatrix} = 0,$$

where $x = Q - E$,

With $a = -1{\cdot}92$ the roots of the determinant are derived as $-103{\cdot}75$, $-1{\cdot}92$, $-6{\cdot}33$, $1{\cdot}92$, $1{\cdot}53 + 0{\cdot}69\,i$, $1{\cdot}53 - 0{\cdot}69\,i$. Rejecting complex roots the following energy values for levels have been obtained.

$Q + 103{\cdot}75$, $Q + 1{\cdot}92$, $Q + 6{\cdot}33$, $Q - 1{\cdot}92$.

Considering the energy level represented by the root $Q - 1{\cdot}92$ as ground level and the level represented by root $Q + 1{\cdot}92$ as excited level, the energy value of the transition between those two levels is of magnitude 3·84 electron volts, which corresponds to an absorption at λ 3228. The experimentally observed absorption is at λ 2952. Similar calculated and observed absorption regions determined by Sklar for benzene are at λ 2470 and λ 2590 respectively.

Further details of the calculations will be published elsewhere.

Andhra University, G. VISWANATH.
Waltair,
July 28, 1952.

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DOLERITE DYKE NEAR SHIHULIBARI, N. MANBHUM, BIHAR

NORTH-WEST of the Panchet Hill, beyond the Raniganj Coal Field and west of it, several dykes are seen to occur in the archaean amphibolite country rock, cutting across their structural trends. The megascopic structure and the petrology of one such dyke that lies beautifully exposed on the river Utla, west of Shihulibari (86° 44′ 40″, 23° 39′), were studied in detail from 16 specimens collected at regular intervals. The dyke is approximately 68 ft. wide.

The dyke trends 340° and cuts vertically across the northerly dipping metamorphites which have a general strike of 70°. The dyke shows several sets of joints which are comparatively better developed close to the two walls adjacent to the chilled borders. Four sets of joints can be recognized, of which one is horizontal, two vertical with their planes parallel and at right angles to the trend of the wall and the fourth steep dipping and diagonal with respect to the wall. The orientation of these joints show no relation to the structural alignments of the country rocks or to the joints that are seen to have been developed in them.

Petrography.—Along the major portion of the width of the dyke the rock is olivine dolerite, and is compact, hard and dark coloured. Considerable variation in grain size can be recognized in hand specimen and the texture becomes coarser towards the middle. The two chilled borders are basaltic in appearance, while the chief constituents are plagioclase, pyroxene, olivine, magnetite and among the secondary minerals, iddingsite, magnetite, limonite, calcite, stilbite, chalcedony, etc.

The texture of the olivine dolertite is typically ophitic to subophitic. The basaltic chilled borders have phenocrysts of plagioclase and pyroxene embedded in a cryptocrystalline groundmass having a little glass and palagonite; the microlites are of augite and plagioclase. They differ considerably from the main portion of the dyke in their mineralogical composition. They are devoid of olivine. While the pyroxene in the main body is enstatiti augite, showing a faint colour ($2V_z = 44°$, $Z \wedge c$, 42°), that in the chilled borders is more calcic ferriferrous augite ($2V_z = 53°$, $Z \wedge c$, 44°). The plagioclase is labradorite and shows, at places, well-marked zoning.

Apophyses are seen to arise out of the main body of the dyke and traverse the country rocks at various angles. The thin section of one such shows a dark brown to brownish black glass with a few phenocrysts of plagioclase and pyroxene. The pyroxene is decidedly more calcic and ferriferous. In the thin section the apophys is seen to send thin stringers within the amphibolite and both have incorporated broken xenocrysts of amphibole and xenoliths of the amphibolite assemblage. The stringer is almost completely glassy, with very few fine grained phenocrysts of augite and plagioclase. It continues within the amphibolite as a calcite vein. Similar cross-cutting thin stringers of calcite (sometimes accompanied by quartz) are seen also to arise out of the main body of the apophys or of the dyke.

The absence of olivine and the more ferriferrous nature of the augite in the chilled borders suggest that these phenocrysts crystallized subsequent to the crystallization of those of the central portion. The dyke was emplaced towards the last stage of crystallization when only a minimum liquid was present, sufficient to impart to the rock the required mobility. This liquid, squeezed outwards, was chilled due to the sudden cooling in contact with the wall, into a basaltic rock.

The point of more serious import is the proof that there was a relative enrichment of Fe over Mg and of Ca in the late liquid. This enrichment of Ca is further proved by the presence of calcite in the stringers and of cross-cutting calcite veins. The Ca may have been primary late-magmatic, or it may have been incorporated

from the calc-magnesian metamorphites which appear as a common variant of the amphibolite country rock.

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July 24, 1952.

PERIODATE OF URANIUM

C. F. RAMMELSBERG[1] found that when uranium tetrachloride is treated with potassium periodate, a greyish green precipitate of uranous periodate is formed, which soon passes into yellowish-white uranyl periodate, $UO_2(IO_4)_2$. The authors have found that on adding potassium metaperiodate solution to a warm saturated aqueous solution of uranyl nitrate, a yellowish-white precipitate of $UO_2(IO_4)_2.2\,UO_3$. is formed. This compound was filtered, washed with hot water till free from nitrate, dried in an electric air oven at 60° C. and analysed. Uranium content of the periodate was determined by the oxine method.[2] Percentage of iodine and available oxygen in the compound were estimated by Kimmins' method modified by Bahl and Partington.[3] The analysis gave (mean of 5 determinations, each being duplicated), U 58·96 per cent., I_2 20·83 per cent., O_2 10·28 per cent.

On heating the compound decomposes

$$UO_2(IO_4)_2.2\,UO_3 \rightarrow UO_2 + 2\,UO_3 + I_2 + 4\,O_2$$

to give 10·46 per cent. of available oxygen. The calculated values of uranium and iodine in this compound are 58·35 per cent. and 20·74 per cent. respectively.

The analytical and calculated values of uranium, iodine and available oxygen in the compound thus agrees with its formula $UO_2(IO_4)_2.2\,UO_3$.

Chemistry Dept., BALWANT SINGH.
Panjab University College, APAR SINGH.
Hoshiarpur (East Punjab), ROSHAN SINGH.
July 5, 1952.

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SPRAY DRYING OF INDIAN GOOSEBERRY JUICE

ADEQUATE supply of ascorbic acid has always been an intriguing problem, as consumption of citrus fruits and fresh vegetables is badly restricted amongst the majority of India's population owing to their high cost. Amla, *Emblica officinalis* (Indian gooseberry) available in plenty during a particular season in India, has been shown to be a rich source of vitamin C.[1] Further, Giri, *et al.*,[2,3] and Damodaran, *et al.*,[4,5] have shown that this vitamin in amla is very stable. Ranganathan[6] observed that dehydrated amla could be powdered and made into tablets. The tablets retained the ascorbic acid activity to a fair degree for about three months. Giri[1] has also described a procedure for obtaining a powder rich in ascorbic acid from amla.

Attempts were made to spray-dry the amla juice using Bowen laboratory spray-dryer. The product was sticky and the recovery was unsatisfactory. Owing to the poor total solid content (below 10 per cent.) of the juice, the feed rate had to be maintained below half a litre per hour with a drying temperature of 100° C. Under these conditions the destruction of ascorbic acid was also high.

It was considered desirable to increase the total solid content of the juice by dissolving common salt to the extent of 20-25%. This liquid was fed at 1½-2 litres per hour. It was observed that a very fine powder of salt collected in the receiver. This powder was not sticky and on analysis showed a vitamin C content of 8·6 mg. per g. of salt. As sodium chloride forms a daily dietary essential, fortification of salt with ascorbic acid in the above manner would afford a safe protection against scurvy, gingivitis, and other symptoms such as weakness, malaise, loss of weight, vague pain in the extremities, slight pallour or anemia and mild changes in temperament which are definitely known to be caused due to lack of ascorbic acid in the diet. Further studies are in progress.

The authors desire to express their thanks to Prof. K. V. Giri for suggesting this investigation.

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Indian Inst. of Science, S. BALAKRISHNAN.
Bangalore, R. RAJAGOPALAN.
July 5, 1952.

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SEPARATION AND IDENTIFICATION OF SUGARS IN FRUITS BY CIRCULAR PAPER CHROMATOGRAPHY

USING the horizontal migration method of paper chromatography Rao and Beri[1] determined the R_f values of some sugars. The present investigation deals with the separation and identification of sugars in some fruit juices and honey using circular paper chromatography, recently developed in our laboratory.

The technique used for finding out the R_f values and for identification by running mixed chromatograms are the same as described by Giri and Rao.[2] For the colour development, the chromatograms were sprayed with aniline hydrogen phthalate.[3] The R_f values on the circular paper chromatograms with butanol-acetic acid-water, phenol saturated with water, mesityl oxide, collidine saturated with water, ethyl acetate-water-pyridine (2 : 1 : 2), ethyl acetate-water-acetic acid (2 : 1 : 2), acetone containing 25 per cent. water, and *n*-butanol-water-ethylacetate (2 : 1 : 2) as developing solvents were determined. Butanol-acetic acid-water[4] was found to be the most suitable among the developing solvents tried for the identification of commonly occurring sugars like glucose, fructose and sucrose. The relative positions occupied by different sugars when chromatogramed using butanol-acetic acid-water as the developing solvent were given below along with their R_f values.

Sugar	R_f value
Maltose	0·26
Lactose	0·28
Sucrose	0·31
d-galactose	0·35
d-glucose	0·36
d-mannose	0·38
l-sorbose	0·40
d-fructose	0·40
d arabinose	0·41
d-xylose	0·43

It was observed that clear separation can be obtained between sugars having a difference of 0·02 in their R_f values by adopting the technique of multiple development and running the chromatogram for 25 hr. in each run. A slight difference in the shade of the colour was also observed between the different sugars when developed with aniline hydrogen phthalate which facilitates the identification of them.

The juice from the ripe fruits was prepared by adding alcohol to a concentration of 80 per cent. (*v*/*v*) and extracting in a Waring blendor. The solution was filtered and the clear liquid was used for spotting on the paper. In this way glucose, fructose and sucrose have been identified in the fruits of orange, lemon, sweet lemon, banana and in honey. It was not possible to detect sucrose by the ordinary chemical methods while its presence was demonstrated by chromatography. Honey contained a greater concentration of levulose while other fruit juices contained sucrose in higher concentration.

Circular paper chromatography is very handy for the detection of adulteration of honey with sugar sirup as honey thus adulterated will show a definite band of sucrose even if added in very small quantity. It is interesting to note that the minerals and pectins present in fruit juices do not interfere with the movement of sugars. No pre-treatment with resins to remove inorganic impurities was found necessary.

Thanks are due to Professor K. V. Giri, for his keen interest in this investigation.

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July 17, 1952.

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SOME ARYL AND ALKYL-SULPHURYL-BIS-GUANIDINES AS POSSIBLE ANTIMALARIALS

THE discovery of N^1-*p*-chlorophenyl-N^5-isopropyl biguanide[1] and its unique antimalarial property led to extensive researches in this virgin fields of biguanides and guanidine derivatives. Keeping in view the interesting results obtained by King and Tonkin[2] in the field of guanidines as also the very encouraging pharmacological data obtained in this laboratory with aryl and alkyl guanidine derivatives of sulphonamides,[3] it was considered worthwhile to prepare a series of compounds which would have two guanidine residues linked with the active SO_2 group of sulphonamides.

The following sulphuryl-bis-guanidines of Type I have been prepared.

These bis-guanidine compounds were prepared by reacting 2 mols. of the appropriate guanidine base with 1 mol. of sulphuryl chloride in an inert and thoroughly dry solvent

R NH—C—NH—SO_2—NH—C—NH R Type I.
‖ ‖
NH NH

	R	M.P. Hydrochloride	M.P. Base
1	H—	108° C.	91° C.
2	CH_3—	128° C.	94° C.
3	$-CH_2-CH(CH_3)_2$	148° C.	111° C.
4	C_6H_5—	152° C.	123° C.
5	p—Cl—C_6H_4—	212° C.	181° C.
6	p—Br—C_6H_4—	216° C.	183° C.
7	p—I—C_6H_4—	232° C.	207° C.
8	p—$(Me)_2$—C_6H_3—	227° C.	204° C.
9	p—Me—C_6H_4—	215° C.	190° C.
10	p—Me—C_6H_4—	205° C.	193° C.
11	NH_2—C_6H_4—SO_2—	197° C.	177° C.

like benzene, acetone, etc. The guanidine bases were obtained from their salts by treatment with molecular proportions of metallic sodium in dry acetone. The free bases of the bis-guanidine salts were obtained by the addition of the requisite amount of dilute alkali, to an alcoholic solution of the salts. Both the salts and bases of the bis-guanidines were crystallised from either alcohol or dilute alcohol.

The compounds are awaiting pharmacological examinations. Full details will be published elsewhere.

Our sincere thanks are due to Dr. B. H. Iyer, M.Sc., Ph.D., for the keen interest shown by him in these investigations.

Dept. of Organic Chemistry, S. N. Sur.
Indian Institute of Science, S. S. Guha.
Bangalore-3, P. C. Guha.
July 22, 1952.

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A NEW PRESERVATIVE FOR SUGAR-CANE JUICES

Sugar factories in India generally add 0·5 g. of mercuric chloride per litre of the juice for purposes of preservation.

The recent work of Gundu Rao,[1] however, shows that 0·5 g. of mercuric chloride per litre of juice can preserve for 10 hours only; this may have to be reinforced by refrigeration for over 24 hours preservation. There are several factories having no refrigerators and there is thus scope for a definite 24 hours preservative for cane juices in sugar factories.

Introduced recently as germicides and insecticides, the use of D.D.T. and "Gammexanes" rapidly spread in India to several agricultural crops including sugarcane. The other new germicides, namely, some of the quarternery ammonium compounds[2] which are already applied to beat sugar juices are not available in India yet. Therefore, the former products, D.D.T. and "Gammexane", P. 520 were applied to sugarcane juices at the rate of 5 g. per litre to test their antiseptic properties and the results obtained are reported in this note. (Gammexane P. 520 is stated by the manufacturers Mrs. Imperial Chemical Industries Ltd., to contain 50% of benzene hexa chloride, 6·5% Gamma Isomer, the rest being wetting and dispersing agents, fillers, etc.). While D.D.T. preserved juices showed early signs of fermentation the drop in purity being 1·5 units in 8 hours and 10 units in 24 hours, the Gammexane P. 520 preserved juices kept on for over 48 hours. The results obtained with (1) Raw cane juices of high and low density, (2) Clarified sulphitation juice, and (3) Filter press juice (which generally shows signs of fermentation due to stagnation), are tabulated below:

Table showing preservation of different cane juices with gammexane P. 520

Sl. No.	Time in hrs.	R. Bx.	Pol.	R. Pty	Time in hrs.	R. Bx.	Pol.	R. Pty.
	Raw Juice, High Density				Raw-Juice, Low Density			
1	0 hrs.	17·07	16·03	93·9	0 hrs.	9·83	9·29	94·5
2	17 ,,	17·07	15·95	93·5	6 ,,	9·83	9·32	94·5
3	24 ,,	17·26	16·07	93·1	21 ,,	9·86	9·32	94·9
4	48 ,	17·86	16·69	93·5	45 ,,	9·96	9·35	93·8
5					69 ,,	9·86	9·35	95·5
	Clarified Juice				Filter Press Juice			
1	0 hrs.	20·5	16·82	82·0	0 hrs.	18·83	15·11	80·2
2	7 ,,	20·32	16·86	83·0	12 ,,	18·72	15·25	81·5
3	20 ,,	19·92	16·80	84·3	24 ,,	18·47	15·8	81·6
4	37 ,,	20·20	16·74	82·9	36 ,,	18·62	14·94	80·2
5	50 ,,	20·42	16·77	82·1	48 ,	18·54	15·03	81·1
6	68 ,,	20·26	16·63	82·1	60 ,,	18·68	15·04	80·6
7	86 ,,	20·27	16·61	82·0	81 ,,	18·66	14·87	79·7

(R. Bx = Refractometric Brix corrected to 28° C
R. Pty. = Refractometric Purity.)

These figures show that Gammexane P. 520 at the rate of 5 g. per litre keeps raw juices of different densities for well over 24 hours. Its

preservative effect is more pronounced on clear juice and the same effect on filter juice (which is generally a fermenting product) is of particular interest.

The application of this new preservative in all its aspects is under investigation and details will be reported elsewhere. Our thanks are due to Sri. M. H. Prasad and Sri. K. G. Rao, for the facilities provided.

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June 26, 1952.

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ERROR INVOLVED IN THE GRAVIMETRIC DETERMINATION OF LYSINE IN THE PRESENCE OF HYDROXYLYSINE

TURBAU[1] AND SCHNEIDER[2] have reported two methods for the determination of lysine in proteins; the first based on the precipitation of lysine from purified base solutions as the copper-benzilidene complex and the second dependent on its precipitation as the styphnic acid (2, 4, 6-trinitroresorcinol) derivative after the prior removal of arginine from base fractions.

We had occasion to study these two methods in examining the possibility of using the removal of the lysine complex from gelatin base fractions as a means of concentration of hydroxylysine. This, however, proved impossible for reasons stated below and the isolation of hydroxylysine had to be effected by use of other novel properties of the amino acid.[3]

The present work confirms Turbau's observation that working with pure lysine dihydrochloride the complex (M.P. 232°) separates out in yields of 96-99%, and thus forms a good basis for the gravimetric determination of lysine. Further, as the author reported, casein was found to contain 11·24% of the protein N as lysine. However, when the precipitation of the complex was attempted from base solutions obtained by electric transport of gelating hydrolysate or collagen hydrolysate—collagen and gelatin are the only two proteins found to contain hydroxylysine[4]—it was observed that hydroxylysine also got precipitated quantitatively. Analysis of the samples from various lots, after decomposition with acid and H_2S, by the method of Van Slyke[5] revealed a hydroxylysine content of 7·5-13%. Recrystallisation of the samples could not materially alter the hydroxylysine content of the samples.

Similarly, having confirmed Schneider's work[2] concerning the use of styphnic acid for precipitation of lysine quantitatively (97-98%) from the phosphotungstic acid fraction, in the presence of 80% of alcohol, its utility as a selective precipitant from gelatin base fractions was sought to be assessed. Here again the co-precipitation of hydroxylysine was observed, the content of hydroxylysine derivative in the various samples ranging from 7·1-10%. Recrystallisation from 50% alcohol led not only to heavy losses, but also the retention of as much as 5-6% hydroxylysine in the sample, though leaving 15-17% of the derivative in the mother liquors.

Likewise, Kurtz's method[6] for the isolation of lysine through the copper benzoyl complex, yields crude benzoyl lysine samples which have a content of near 6·8% of benzoyl hydroxylysine. This proportion is not materially altered on recrystallisation. In converting the benzoyl lysine to lysine dihydrochloride, samples obtained had often a hydroxylysine N content 4·0-6·1%, though in a few cases the content was very negligible.

In view of the above, it would be well to be cautioned against the indiscriminate use of the Turbau[1] and Schneider[2] procedures for lysine determination to proteins or other crude protein products in which hydroxylysine occurs. If at all used, in these cases, allowance may be made for the hydroxylysine present by determination of the same in the samples by the Van Slyke[5] procedure, without resorting to the ineffective procedure of recrystallisation. Also, Kurtz's method[6] of isolation of lysine from gelatin invariably leads to contamination by hydroxylysine and this should be borne in mind when such samples are to be used for analytical, nutritional or other purposes.

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CHLORINATION OF ILMENITE

ALTHOUGH selective chlorination of ilmenite has been reported by some workers,[1] conditions favourable for the preparation of products containing high content of titanium dioxide and low in oxides of iron do not appear to have been determined before.

In the investigation of the problem, Travancore ilmenite having the following percentage composition was employed: $TiO_2 = 60{\cdot}1$, $FeO = 11{\cdot}0$, $Fe_2O_3 = 24{\cdot}8$. The mineral was powdered to pass through 150 and 200 mesh sieves and then briquetted by the use of various binders, after incorporating different proportions of powdered charcoal together with substances like iron pyrites or coal with high percentage of sulphur, which could be expected to catalyse the reaction of chlorine with the iron oxide present in the mineral. Among the various binders employed, ferric chloride proved to be the most suitable, because it also appeared to promote the preferential chlorination of the iron oxide present in the ilmenite.

Experiments conducted on the above lines employing about 30 g. of ilmenite in each case show that at a temperature of 500-600° C., ilmenite briquetted with charcoal to the extent of about 6 per cent. by using ferric chloride as a binder, yields on treatment with chlorine, residues enriched to over 90 per cent. of TiO_2 and containing mere trace of iron.

My best thanks are due to Dr. B. Sanjiva Rao for suggesting the problem and Dr. C. C. Patel for guidance during the investigation.

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MANGANESE METABOLISM

THE author has adduced evidence[1] that manganese is necessary for ascorbic acid synthesis in plants and animals. Among factors which govern the ability of some animal species and inability of others to synthesise ascorbic acid an important one is the reaction in the small gut in maintaining a suitable pH for enzyme activity and favouring the retention of a minimal concentration of manganese by the tissues, the seat of synthesis being the small intestines. Animal species able to synthesise ascorbic acid usually have a higher manganese content in their tissues than the other group (Table I). This appears to be due to the more acid condition in the small gut of the former group. This communication presents evidence that more manganese is retained by the tissues in acid conditions.

TABLE I
Manganese content of animal tissues

	mg./100 g. moist tissue		mg./100 g. dry tissue	
	small intest.	liver	small intest.	liver
Man ..	..	..	0·52	0·50
G. Pig ..	0·14	0·16	0·70	0·62
Rat ..	..	0·27	..	..
Rabbit ..	..	0·30	1·16	1·21
Fowl ..	0·26	0·28	1·29	1·05
Goat ..	..	0·35	1·10	1·19

Two groups of albino rats were kept on a basal diet (casein-20; glucose-68; arachis oil-5; cod liver oil-2; salt mixture*-5) practically free from manganese (0·2 γ/g.). They were given daily supplements of synthetic B vitamins. Each individual rat was housed in a Hopkins metabolism cage made of heavily galvanised sheet and wirenetting without rust. 10-15 grams of the dry ration mixed with distilled water were given and consumption was almost full in each case. The animals had *ad lib.* access to distilled water provided in glass bulbs. The rats were given orally 0·5 mg. manganese daily with a pipette. This method of manganese feeding is better than given in the diet. It ensures a sure and constant manganese intake. Possible contamination of the excreta with manganese is excluded as traces of diet falling through cannot significally alter the manganese content of the excreta. Manganese intake through the diet was negligible and small differences in food consumption had practically no influence on the total manganese consumed.

The animals were kept on this regime for one week to reach a state of equilibrium. On each of the three succeeding days the rats in one group were given 50 mg. sodium bicarbonate each while the rats in the other group were given 16 mg. ammonium chloride each, both by the mouth. 24 hours after the dosing, the urine and fæces were collected on the three succeeding days and analysed for their manganese content by the method of Ray.[2] The

TABLE II

Manganese excretion and retention by rats (mg./24 hrs.)
Mn given = 0·5 mg./24 hrs.

Group I ($NaHCO_3$)				Group II (NH_4Cl)			
Excreted			Retained	Excreted			Retained
Urine	Fæces	Total		Urine	Fæces	Total	
·012 (·008–·016)	·31 (·25–·41)	·322	·178	·004 (·002–·005)	·193 (·07–·30)	·197	·303

Statistical Analysis: $t = 2·73$; $p = ·02–·05$ (significant); degrees of freedom = 5.

result is given in Table II. It is seen that the group given ammonium chloride excreted less and retained more manganese in their tissues. Evidently a more acid reaction in the gut favours the retention of greater amounts of manganese in the tissues of animals. This probably explains why the tissues of guinea pigs, in which the pH in the small gut is higher than that in rats and other animals, are poorer in manganese content. In men the same explanation holds. It is interesting to note that Brückmann and Zondek[4] found only 3 in 13 human livers to have 1 mg. per cent. manganese. It may be noted that the reaction in the small gut of man is variable and is controlled not only by the acid base balance of the diet but also by the nature of its contents. The three 1 mg. per cent. cases might have been taking an "acid" diet while alive.

Part of this investigation was carried out in the Department of Biochemistry, University of Oxford. I am indebted to Prof. R. A. Peters, F.R.S., for hospitality.

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* NaCl–30; KH_2 PO4–30; Ca_3 $(PO4)_2$–30; $MgSO_4$·7 H_2O–10·0; $FeSO_4·7H_2O$—5· 0; $CuSO_4,5H_2O$—0·15; KI—0·1 trace of NaF. Ca—11¹mg./g.; Ca/P—0·91. Use of Fe″salt is not contraindicated[2] as the diet contains sufficient vitamin E contained in the arachis oil,

A METHOD TO DIMINISH THE AMOUNT OF PIGMENT EXTRACTED FROM URINE BY FAT SOLVENTS IN COLORIMETRIC 17-KETOSTEROID ESTIMATION

To estimate urinary 17-ketosteroids using the colorimetric method of Zimmermann,[1] extraction from acid hydrolysed urine by fat solvents such as ether, benzene or carbon tetrachloride is necessary. Deep red urinary pigments are some of the undesirable substances also extracted. Although the colour due to these pigments is low at the final dilution, it may be necessary to allow for this in a special blank test.[2,3,4] It has now been found that this blank can be avoided when a little copper sulphate is present in the urine before acid hydrolysis. The urine was collected in copper sulphate to prevent formation of inconvenient amounts of ammonium carbonate.[5] Copper sulphate thus serves a double function. Experience with over 70 samples showed that copper sulphate prevents the extraction of the red pigment with carbon tetrachloride. A few urines gave violet extracts even in the presence of copper sulphate, but the red pigment constantly observed when untreated urines were worked up was always absent. Precipitation of "urochrome" by salts of heavy metals was already noted by Berzelius and subsequently by Dombrowski,[6] but this does not seem to have been utilised to obtain lipoidal urinary extracts free from red pigment. Although the precipitate dissolves in acid, the pigment is not thereby rendered extractable by carbon tetrachloride. The copper sulphate should be added to the urine, as neither neutral, acidic nor ammoniacal solutions of copper sulphate remove the red pigment from carbon tetrachloride extracts.

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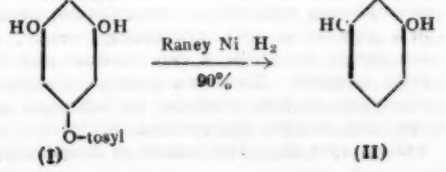
A NEW METHOD FOR THE PREPARATION OF γ-RESORCYLIC ACID (2:6-DIHYDROXYBENZOIC ACID)

IT has been stated[1] that sodium γ-resorcylate is more active than sodium salicylate as a therapeutic agent in rheumatic fever. The availability of γ-resorcylic acid has been discussed very recently[2] and Mauthner's method[3] from *m*-dinitrobenzene was chosen for the preparation of the acid; the yield was improved from 5 to 15 per cent. by a slight modification in the final demethylation stage.[2] In the course of our work on Raney nickel reductions[4] we have found that a new and convenient route to γ-resorcylic acid (II) is an application of the method of Kenner and Murray for the cleavage of sulphonic esters with Raney nickel.[5] The desired acid is thus obtained in three stages from phloroglucinol in an overall yield of about 75 per cent. Phloroglucinol carboxylic acid is converted into the mono-*O*-p-toluenesulphonyl derivative (I; m.p. 180°, *dec.*), the unhindered hydroxyl group *para* to the carboxyl group reacting, by treatment with 2 mols. of caustic potash and one mol. of p-toluenesulphonyl chloride in water at room temperature with shaking until the solution is neutral to litmus and the odour of the chloride disappears (2 hours), followed by acidification. The acid (I) is dissolved in water (300 parts) containing potassium bicarbonate (0·5 part) and the solution is agitated with Raney nickel (5 parts) for 3 hours at room temperature (29°), while passing a slow stream of hydrogen. The mixture is filtered, acidified with concentrated hydrochloric acid, saturated with salt and ether extracted. By removal of ether and crystallization of the residue from water γ-resorcylic acid (II) is obtained as colourless needles, m.p. 166-67°, undepressed by a sample prepared by Limaye's method.[6] A further quantity of the acid is recovered by treating the nickel residue with hydrochloric acid and extracting with ether (combined yield 90 per cent.).



(I) (II)

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ACTIVE RELAXATION OF UNSTRIATED MUSCLE

UNLOADED unstriated muscle relaxes under certain conditions.[1-7] If adrenaline is added to saline in which are immersed unloaded transverse pieces of the stomach muscle of the frog, *Rana tigrina*, or virgin guinea pig's uterus, they lengthen. This may be due to two causes: (*a*) active relaxation, (*b*) something pulling it out, such as elasticity of connective tissues or membranes, etc. If the latter explanation is correct, it means that the muscle is loaded and relaxation really passive. To test this the muscle is treated with those agencies which hasten relaxation of a visibly loaded muscle, but retard that of an unloaded muscle. These are: (*a*) asphyxia, (*b*) sodium cyanide (1 in 10,000), (*c*) iodoacetic acid (1 in 10,000), (*d*) gradual lowering of temperature from 30-37° C. to about 5-10° C. All these procedures diminish metabolism and hasten relaxation of a loaded muscle even if the load is very light. Thus loaded hen's gut, guinea pig's uterus and human appendix relax when asphyxiated at 37-38° C., or if treated with sodium cyanide or iodoacetic acid or on lowering of temperature; unloaded muscles do not relax at all. Loaded dog's stomach muscle from the cariac end also

relaxes under above conditions, as it usually shows lactic tone; muscle from pyloric end may not relax as it usually shows alactic tone. Dog's stomach muscle may be continuously stimulated with potassium chloride (this ion is suitable as it produces sustained tension) and then asphyxiated or treated with sodium cyanide, when it promptly relaxes if loaded but not if unloaded.[4] Frog's stomach muscle from the cardiac end, when treated with the above four agencies, also relaxes if loaded but not if unloaded; it is usually experimented upon at 25-30° C., though at higher temperatures also, the results are similar.

The above experiments show that such extraneous factors as elasticity of connective tissues, membranes, fluidity of muscle, etc., are of no significant importance in the lengthening of an unloaded unstriated muscle. Further, it has been shown that for a loaded muscle to lengthen, the load must exceed a certain minimum value;[11] so, if the elongation of an unloaded muscle was passive, the force producing the elongation must exceed the above minimum value and the muscle, when immersed in saline, should gradually lengthen; but exactly what happens is the opposite.

Sodium cyanide (1 in 10,000) paralyses frog's stomach muscle and the guinea pig's uterus and activity is partially restored with 0·1 p.c. glucose. Relaxation of these unloaded muscles is also abolished by cyanide and partially restored with glucose. These and the above experiments conclusively prove that the lengthening of an unloaded muscle is due to active relaxation during which metabolic processes are involved.

There are other subsidiary experiments which support the above conclusion that one kind of relaxation in unstriated muscle is active. The muscle may contract when asphyxiated or treated with sodium cyanide. The immediate contraction is usually due to asphyxial hyperexcitability and to anaerobic metabolism, as glucose increases it. The later contraction on asphyxiation is decreased by glucose, the effect of which is abolished by iodoacetic acid. The muscle may be completely relaxed by glucose and hence relaxation appears to be active.

It is well known that isolated unstriated muscle contains much smaller quantities of glycogen, lactic acid, creatine phosphate and adenosine triphosphate than skeletal muscle, in spite of the fact that it is tonically contracted and it may further contract on exhaustion. In conformity with these findings are the facts that unstriated muscle may use less oxygen and produce less lactic acid when tonically contracted and behave in an opposite manner when relaxed.[8,9,10] Oxygen consumption and allied experiments may be complicated by the fact that a particular substance or length may have some specific effect on metabolism not related to relaxation or contraction. In some experiments these complicating factors can be excluded. For example in frog's stomach muscle, ammonium ions at pH 7 produce relaxation and increase its oxygen consumption and production of lactic acid. The experiment is performed under isometric conditions and even if there is any increase in length of the muscle during relaxation, this is not the factor to cause increase in metabolism, as increase in length in this muscle at pH 7 causes a decrease in metabolism.[9]

Any apparent relaxation due to arrangement of fibres in a muscle has been excluded by many different kinds of experiments. In the pharyngeal retractor of the marine worm *Phascolosoma*, there are only parallel bundles of longitudinal fibres. In pieces of transverse muscle of the frog's stomach, effects due to contraction of longitudinal fibres are excluded by the following experiments: (1) Both longitudinal as well as transverse fibres may lengthen. (2) The experiment can be repeated several times on the same piece of muscle, relaxation and contraction occurring on addition and withdrawal of adrenaline respectively. If elongation was due to contraction of the fibres at right angles and relaxation be passive, this could happen once only. (3) A tiny piece of the transverse coat can be cut off and relaxation watched under a microscope on addition of adrenaline. (4) The middle part of the frog's stomach contains least longitudinal fibres and it lengthens most; so that, as expected, the longitudinal fibres hinder rather than promote relaxation. The guinea pig's uterus will show relaxation if split longitudinally from end to end. The experiment can be repeated as in frog's stomach muscle and relaxation of a small piece of longitudinal fibres noted under the microscope.

In transverse pieces of dog's stomach muscle, elasticity of connective tissues and complex arrangements of muscle fibres may play a part in producing relaxation. An unloaded piece is first stimulated with alternating current, and the extent to which it can contract and then relax is noted. The same amount of sustained shortening is then produced by potassium ions, and the muscle asphyxiated or treated with sodium cyanide. The extent of lengthening is

noted and percentage of relaxation due to these extraneous factors calculated. This may amount from 5 to 100 p.c. This phenomenon occurs at about 20° C., a rather unusual temperature, for mammalian tissues, and is absent at high temperatures as mentioned above, though a loaded muscle relaxes more readily. The relaxation at 20° C. is, therefore, due to some other cause, probably to the dissociation of metabolic mechanisms for contraction and relaxation. At this temperature, the source of energy supply for contraction is more aerobic than for relaxation, so that cyanide or asphyxia stops the stimulating action of potassium, and the muscle relaxes actively as on cessation of stimulation.[12]

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A TECHNIQUE FOR DETERMINING ACCURATELY THE AREAS OF CONTACT OF THE BODY OF INSECTS IN LOCOMOTION WITH THE GROUND SURFACE

KENNEDY, *et al.*,[1] emphasised the greater effectiveness of the toxic material (*Dinitro-orthocresol* DNOC) when applied to the legs than to other parts of the body of *Locusta migratoria migratorioides* R & F. Areas of the legs being the primary regions which come into contact with the walking surface sprayed or dusted with insecticides. Slifer[2] biometrically measured the ratio of arolium length to claw in various sub-families of Acridiidæ in order to estimate the degree of contact made by the plantar surface of arolium to ground level.

No attempt, however, has so far been made to ascertain the extent of such areas of contact in a living insect. The present authors have evolved a technique which would estimate accurately the extent of areas of contact of legs or part thereof to the ground surface in the case of *Schistocerca gregaria* Forskal, while the insect is in normal locomotion.

Various methods, *e.g.*, making the insect under test to walk over well-inked glass plates or plates thinly covered with fine talc and subsequently examining the organs for impressions were tried. With an insect of frequently jumping habit of the type of *S. gregaria* (adults and mature nymphs), both the methods were found to be messy and useless for, while attempting to jump, the insect would frequently slip thereby spilling the ink or scattering the fine powder all over the body. Moreover, these test-insects being true phytophils did not naturally like walking over smooth or wet surfaces. An indirect method, therefore, had to be adopted and the following technique evolved. The entire plantar surface of the tarsus and pretarsus (with appendages) of each side was painted thinly with a semi liquid adhesive cement ('Tenasitine', a product of Kay Brothers Ltd., Stockport, England) with a very fine brush and the insect allowed to walk normally over a fairly big sized coarse blotting paper, under cover of a glass cylinder for about fifteen minutes. The insects were then taken out and the tarsus, pretarsus along with euplantulæ and arolium, were thoroughly examined under a binocular microscope for tracing out the fibres picked up from the surface of the blotting paper by the portions of leg covered by the adhesive cement which had come into contact with the blotting paper. On an exa-

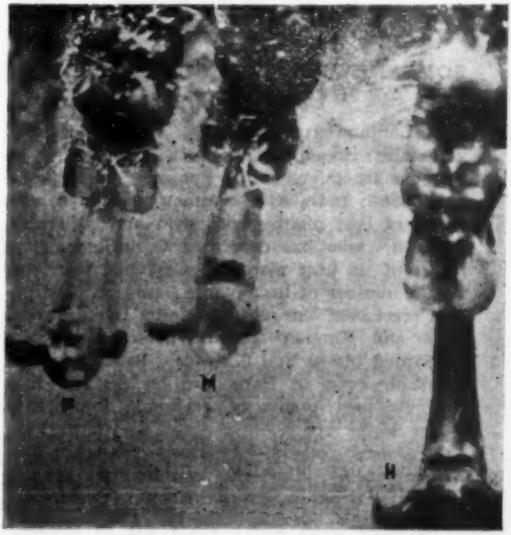

FIG. 1. Tarsal segments of *Schistocerca gregaria* Forskal. Positive areas of euplantulæ indicated by white streaks of fibres. F. M. H.—Fore-, Mid-and Hind-tarsi.

mination of the dissected out legs, it was found that whereas fine fibres could be very easily traceable in groups on the euplantular surfaces of the tarsus, no fibre could be traced on the arolium of the pretarsus (Fig. 1). Unfortunately, as the height of the jar used was insufficient, the effect of jumping on the arolia could not be determined for the present. It is thus evident that the tarsi (more particularly the euplantular surfaces) play a very significant role in *S. gregaria*, in picking up the particles of an insecticide and their subsequent transference to hypodermis.

Besides the plantar surfaces of the legs other parts of the body, *viz.*, parts of some thoracic and abdominal sternites appear also to come in contact with the ground or other surfaces during their normal course of activity and thus get abraded.

Experiments are being conducted to ascertain such areas in *S. gregaria*, both adults and hoppers of various stages.

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SOME NEW HOSTS AND CONTROL OF THE LANTANA BUG

THE Lantana Bug, *Orthezia insignis* Douglas (Coccidæ : Homoptera), is a widespread phytophagous insect, which is known[1,3] to occur all over South India as a common pest on a wide range of host plants—both wild and cultivated.

Green,[2] who has described *O. insignis*, gives a list of its host plants in Ceylon. Morrison[4] lists a number of host plants based on distribution records of the pest. In India Ramachandra Rao[5] and Kannan[6] record it on 50 different cultivated plants and 6 weeds. Recently it has been observed in Bangalore on no less than 30 new host plants of economic importance. These latter are :

Medicinal plants.—Adhatoda vasica, Nees (Acanthaceæ), *Barleria cristata*, L. (Acanthaceæ), *Brassica nigra*, Koch. (Cruciferæ), *Clerodendron inerme*, Gaertn. (Verbenaceæ), *Indigofera* sp. (Leguminosæ), *Lucas aspera*, Spr. (Labiatæ), *Nyctanthes arbortristis*, L. (Oleaceæ), *Ocimum sanctum*, L. (Labiatæ), *Ruta graveolens*, L. (Rutaceæ), *Spilanthes acmella*, Murr. (Compositæ), *Vallaris dichotoma*, Wall. (Apocynaceæ), *Vinca minor*, L. *var. alba* (Apocynaceæ) and *Vitex negundo*, L. (Verbenaceæ).

Horticultural and vegetable plants.—Achimenes sp. (Gesneraceæ), *Amarantus Gangeticus*, L.—two varieties (Amarantaceæ), *Bignonia* sp. (Bignoniaceæ), *Callistephus* sp. (Compositæ), *Chrysanthemum* (Compositæ), *Coleus* (Labiatæ), *Crossandra undulæfolia*, Salisb. (Acanthaceæ), *Ipomœa* sp. (Convolvulaceæ), *Origanum majorana*, L. and *O. vulgare*, L. (Labiatæ), *Pilea* (Urticaceæ), *Rose* (Rosaceæ), *Solanum melongena*, L. (Solanaceæ), *Verbena* sp. (Verbenaceæ) and *Zinnia* sp. (Compositæ).

Green[2] rightly remarks that the Lantana Bug is one of, if not the most, resistant of all scale-bugs towards insecticides, and that it is remarkable that the half-grown insects will often survive treatment that has successfully destroyed the younger and older individuals. According to him fumigation with hydrocyanic acid gas is effective, but the treatment is subject to certain dangers and cannot, therefore, be recommended for general use; sprays with insecticidal soap solutions are the next best. Kannan[6] recommends a spray with fish oil soap at the rate of 1 lb. in 5 gallons of water. However, experience has shown that even repeated sprays with insecticidal soap solutions give only partial control. In an attempt to find a more effective insecticide, some of the newer synthetic insecticides were tested, and of these Folidol E. 605 Conc. 46·6 per cent.—diethyl paranitrophenyl thiophosphate—gave the most satisfactory result in that a spray with 0·06 per cent. solution in water gave a 100 per cent. mortality of all adult and early stage bugs within 24 hours in the field; it was non-phytotoxic, and the residual effect was in evidence for nearly 3 weeks. Folidol—E 605 is a product of the Farbenfabriken Bayer, Leverkusen, and is the same as Parathion but with reduced toxicity for man and animals.

We are thankful to Sri. B. Krishnamurti, Government Entomologist, for suggestions and helpful criticism.

Division of Entomology, S. USMAN.
Dept. of Agriculture, R. N. RAJU.
Bangalore,
August, 1952.

1. Beeson, C. F. C and Chatterjee, N. C., *Ind. For. Rec.*, new ser., Entom., 1940, **6** (3), 1-84. 2. Green, E. E., The Coccidæ of Ceylon, Dulau & Co., Ltd.,

London, 1922, **2**, 418-21. 3. Kannan, K. K., *Rep. Proc. III Entom. Meet.*, 1919, **3**, 857-58. 4. Morrison, H., *Jour. Agrl. Res.*, 1925, **30** (2), 97-154. 5. Ramachandra Rao, Y., *Mem. Dept. Agr. Ind.*, Ent. ser. 1920, **5** (6), 239-314. 6 —, *Department of Agriculture, Mysore State*, General Series Circular No. 46, *The Lantana Bug*, 1931.

MEIOSIS IN *AZADIRACHTA INDICA*

THE meiotic behaviour of *Azadirachta indica* A. Juss. belonging to Meliaceæ is reported here as no such information is available for any species of the Meliaceæ.[1] The somatic chromosome number of *A. indica* has only been recorded recently as $2n = 28$ by Pathak, *et al.*[2]

Examination of smears of pollen mother-cells, fixed in Belling's modified Nawaschin's fluid and stained with crystal violet has shown its meiotic behaviour to be regular. The chromosomes pair regularly and form 14 bivalents during diakinesis as shown in the figure. This confirms

Scattered drawing of Diakinesis showing 14 bivalents (×1,760).

the previous record of the somatic number. The figure also suggests the chromosomes to be quite small in size. Subsequent metaphase and anaphase behaviour is normal.

Thanks are due to Prof. Maheshwari for facilities.

Botany Dept., S. K. MUKHERJEE.
Delhi University,
Delhi 8,
June 30, 1952.

1. Darlington, C. D. and Ammal, E. K. J., *Chromosome Atlas of Cultivated Plants*, 1945. 2. Pathak, G. N., *et al.*, *Curr. Sci.*, 1949, **18**, 347.

MORPHOLOGICAL AND CYTOLOGICAL STUDIES OF *ALBUGO* SPECIES ON *IPOMOEA HEDERACEA*

ON the leaves and stems of *Ipomœa hederacea* Jacq. near Bangalore an *Albugo* was collected and investigated. The fungus incited the formation of white powdery pustules on the leaves which were sporangia. On the stems large cerebriform galls 2 to 2·5 inches in diameter were formed in which the sex organs were developed (Fig. 1). The sporangia measured 15-19 × 13-16 μ and lacked the equatorial thickenings

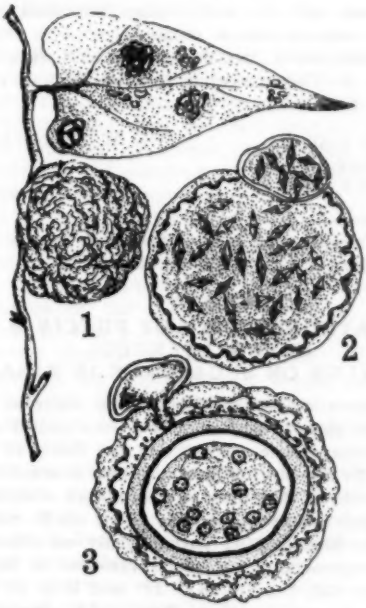


FIG. 1. Habit showing the soreus on leaves and stems, × ½.

FIG. 2. Simultaneous first division in the oogonium and the antheridium, × 400.

FIG 3. Mature oospore, × 400.

characteristic of *A. ipomœæ panduranæ* (Schw.) Swing. The oospores measured 44-54 μ in diameter with a mean of 47·6 μ. The wall of the oogonium was thickened and became confluent with the wall of the oospore in the mature oospore similar to that of *A. evolvuli* (Damle) Safee and Thirumal. The differences in the morphology of the spore forms cross inoculation tests and symptoms produced on the host have been taken into account in considering the *Albugo* species on *Ipomœa hederacea* as a new

variety of *A. evolvuli* for which the name *A. evolvuli* var. *mysorensis* is proposed.

Cytological studies of gametogenesis revealed close resemblance to *A. evolvuli* described by Thirumalachar, *et al.*[1] During first simultaneous division of oogonium and antheridium the dividing nuclei did not show any stage of zonation but were distributed uniformly (Fig. 2). The mature oogonium was uninucleate, and fertilization took place by the migration of a single male nucleus from the antheridium. The mature oospore showed 12 to 16 free nuclei (Fig. 3). The remnants of the nuclei of the periplasm and the antheridium remained persistent even in mature oospore.

Grateful thanks are due to Dr. L. N. Rao and Dr. M. J. Thirumalachar for the help in preparing this note.

Central College, Bangalore, *August* 7, 1952. K. M. SAFEEULLA.

1. Thirumalachar, M. J., Whitehead, M. D. and Boyle, J. S., *Bot. Gaz.*, 1949, **110**, 487–91.

PATHOGENICITY OF *PUCCINIA KUEHNII* (KRUEG) BUTLER ON SUGARCANE IN BIHAR

A SERIOUS outbreak of rust was reported for the first time in this country from Canal Tracts of Bombay State on Co. 475 by Patel, *et al.*[1] Since P. Kuehnii (Krueg) Butler is commonly met with in this State on *Erianthus arundinaceus* and has recently been noted on *E. munja* also by Sharma,[2] its pathogenicity on some of the recommended sugarcane varieties of Bihar, *viz.*, Co. 453, Co. 513, B.O. 10* and B.O. 11 was tested to see whether these wild species of Saccharum could serve as a source of infection. Inoculations were, therefore, made during last winter and it was found that the rust was unable to successfully infect these varieties though *E. arundinaceus* used as control developed rust pustules in due course. Also exposure of these varieties to constant shower of inoculum in natural conditions, by keeping them beneath heavily infected clumps of *E. arundinaceus* for about 4-5 months did not bring about any infection. It, therefore, appears that sugarcane varieties grown on large scale in Bihar are immune to the rust occurring on *E. arundinaceus* at Pusa.

Co. 475 was also included in these experiments because of its great susceptibility to rust in Canal Tracts of Bombay State to see its reaction to *P. Kuehnii* found in this State. As was the case with the varieties mentioned above, this also was found to be immune to the rust.

Central Sugarcane Res. Stn., Pusa, Bihar, *April* 13, 1952. S. L. SHARMA.

1. Patel, M. K., Kamat, M. N., and Padhye, Y. A., *Curr. Sci.*, 1950, **19**, 4, 121-2. 2. Sharma, S. L., *Proc. 39th Ind. Sci. Cong.*, 1952, **3**, 308-9.

* B.O. which stands for Bihar and Orissa is a series of sugarcane varieties bred and selected at the Central Sugarcane Research Station Pusa, Bihar.

EMBRYOLOGY OF THE *PASSIFLORACEAE*

COOK[1] has recorded some embryological features in *Passiflora adenophylla*. The present note deals with an account of the embryology of *Passiflora Leschenaultii* DC., and *P. fœtida* Linn.

The wall of the anther consists of four layers of cells external to the tapetum. The tapetal nuclei are plurinucleate at a later stage. Secondary fusions in the tapetal nuclei are also noticed. The endothecium develops fibrillar thickenings; a stomium is organized. The pollen grain at the time of shedding is two-nucleate and has six germpores (Fig. 1). The exine shows reticulate thickenings. Occasionally, the pollen grains degenerate in the anther locule.

Indefinite number of bitegmic crassinucellate anatropous ovules are borne on three parietal placentæ of the unilocular superior ovary. The micropyle is organized by both the integuments. The archesporium is hypodermal. A massive parietal tissue is present. Megasporogenesis proceeds normally and the development of the embryo sac follows the Polygonum type. In the elongated embryo sac the synergids are hooked and sometimes show a filiform apparatus. The antipodals degenerate early. Double fertilization is observed. The pollen tube is aggressive in its entry often disturbing the egg apparatus and thereby causing degeneration of embryo sac. Cases are also observed where the pollen tube remains in a coiled state in the micropylar end of the embryo sac and even persists in the developing seed.

Endosperm is nuclear and the nuclei usually aggregate at the chalaza in dense cytoplasm (Fig. 2). Later the endosperm becomes cellular. At the same time the endosperm tissue presents an irregular outline due to the development of indentations from the seed coat. The cells of

the endosperm at the chalazal end become multinucleate due to secondary nuclear divisions or uninucleate as a result of secondary fusions. Sometimes, the endosperm disappears even at the free nuclear stage itself due to very vigorous development of a number of indentations.

The three-layered inner and outer integuments contribute towards the formation of seed coat. The middle layers of both the integuments are completely crushed during development of the seed. The innermost layer of the inner integument gets deeply stained and the outermost layer becomes prominently elongated and lignified (Fig. 3). The epidermal layer of the outer integument develops a thickened echinulate external wall. The innermost layer of outer integument remains unstretched (Fig. 3); but at the region of indentations it is pushed inwards (*In.* in Fig. 2).

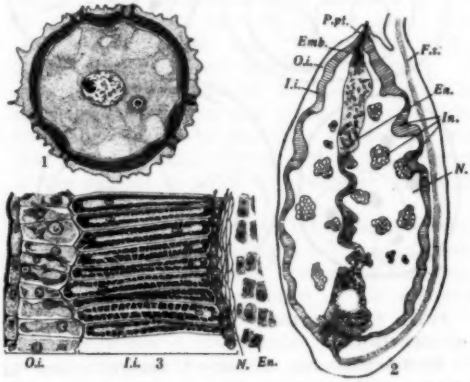


FIG. 1. Mature pollen grain, × 600. FIG. 2. L. S. young seed, × 16. FIG. 3. Portion of seed coat × 180 (*En*, endosperm; *Emb.*, embryo; *F.s*, funicular strand; *I. i*, inner integument; *In*, indentations; *Nu*, nucellus, *O. i*, outer integument; *P. pt.*, persistent pollen tube).

The pitted seeds are arillate and the aril develops very vigorously during post-fertilization stages.

My sincere thanks are due to Prof. L. N. Rao and Dr. K. Subramanyam for guidance and valuable suggestions.

Dept. of Botany, M. V. S. RAJU.
Central College,
Bangalore,
September 9, 1952.

1. Cook, M. T., *Bull. Torrey Bot. Club*, 1909, **36**, 373–74.

APPLICATION OF RUSSEL EFFECT TO THE IDENTIFICATION OF THE HEARTWOOD AND SAPWOOD OF SAL

THE identification of the true heartwood and sapwood of Sal (*Shorea robusta*) has presented considerable difficulties to the wood technologist. As a rule the dark-coloured central portion of a tree or log is called heartwood and the outer portion is called sapwood. In the case of Sal, however, both the heartwood and the sapwood turn to a brownish black colour on exposure. Colour, which is generally the main criterion of distinguishing between the sapwood and heartwood of timbers, can hardly be safely relied upon in the case of Sal.

Sal is a wood which is extensively used in India for the construction of railway sleepers. However, it is only the heartwood that can be used for this purpose as the sapwood is highly perishable and does not last long in contact with the soil. A proper identification of the heartwood and sapwood of Sal is therefore of great industrial importance.

In a paper in the *Indian Forest Bullettin*, Chowdhury[1] outlines a method for the proper identification of the heartwood and sapwood of Sal. His method consists in a microscopic examination of the anatomical structure of the specimen with a view to finding out the presence or absence in them of tyloses. The possibility of the application of Russel effect to the solution of the problem suggested itself to the author and as a consequence the present investigation was undertaken.

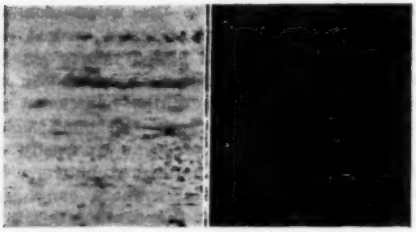
The wood specimens for this experiment were obtained from the Forest Research Institute, Dehra Dun. The author's thanks are due to the Wood Technologist of the Institute for so kindly donating them.

The specimens were cut and shaped to the form of rectangular blocks ($1\frac{3}{4}'' \times 1'' \times \frac{1}{2}''$) and their broad faces were rendered smooth by careful planing.

The heartwood and sapwood specimens were then placed side by side on the sensitised surface of a photographic plate (Ilford Special Rapid). An exposure of 24 hours was given following the experimental procedure adopted previously.[2] On processing the plate in the usual manner the Russel images recorded by the two woods were obtained. A visual examination of the plate revealed that the image impressed by the heartwood was clearly denser than that of the sapwood. Actual densitometer measurements showed that the density of one was nearly double that of the other.

A photograph (positive print) of the pictures

recorded by the two woods is reproduced below, which clearly reveals the pronounced difference between the densities of the images impressed by the two woods.



The experiment was repeated for exposures of 48 hours and 72 hours and for different samples. The results obtained were nearly identical. Details of the experiment together with data obtained will be published elsewhere.

It is thus seen that a study of the Russel effect in the heartwood and sapwood of *Shorea robusta* furnishes a useful method of distinguishing between the two woods. The method has the advantage that it is extremely simple and requires no elaborate or costly equipment.

The author is grateful to the authorities of the Pachaiyappa's College, for the facilities afforded for the conduct of this investigation.

Dept. of Physics, V. P. NARAYANAN NAMBIYAR.
Pachaiyappa's College,
Chetput, Madras,
June 15, 1952.

1. Chowdhury, K. A., *Indian Forest Bulletin*, 1942, 115. 2. Narayanan Nambiyar, V. P., *Curr. Sci.*, 1949, 18, 284-86., *Ibid.*, 1951, 20, 190-91.

ABNORMAL MICROSPOROCYTES IN *CAESALPINIA PULCHERRIMA* SW.

WHILE demonstrating the PMC division in *C. pulcherrima* to students last August, some abnormal microsporocytes were noticed as reported below. Subsequent smears of anthers from a number of plants growing in the area showed that normal tetrad formation is the usual rule. Only in one plant both normal and abnormal microsporocytes were seen, but when the same plant was examined after about a month only normal tetrads were observed. The abnormalities consist in the microsporocytes forming 8, 6 and 3 microspores in addition to a few normal tetrads (Figs. 1-4); the majority, however, possess 6-8 microspores. During the abnormal division there is high pollen sterility, only 8% being fertile in a count of about 500 grains from different flowers. Similar abnormal microspore formation has also been observed in *Cuscuta reflexa*[1] and a number of other plants.

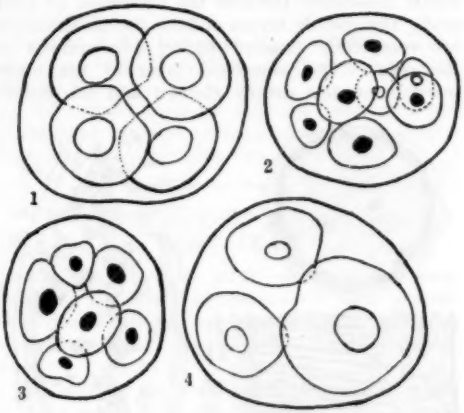


FIG. 1. Normal tetrad; 2-4. Abnormal microsporocytes (× 190).

Darlington[2] has discussed several cases of abnormality in microspore formation and attributed the phenomenon to the variable "behaviour of the dividing cells in which the normal relationships of the spindles to the chromosomes have been upset by failure of pairing. No doubt this is due to a susceptibility to environmental changes". In this case the abnormality was temporary and the normal condition was subsequently restored in the same plant. This abnormality also appears to be created by some sudden change in the internal condition of the plant due to fluctuation in temperature or other environmental factors causing disturbance in the normal meiotic behaviour. The formation of microsporocytes with 8 spores may also be due to further division of the microspores within a tetrad.

Thanks are due to Prof. P. Maheshwari for facilities and encouragement.

Dept. of Botany, S. K. MUKHERJEE.
Delhi University,
July 22, 1952.

1. Johri, B. M. and Tiagi, B., Floral morphology and seed formation in *Cuscuta reflexa* Roxb., *Phytomorphology*, 2, No. 2 (in the press). 2. Darlington, C. D., *Recent Advances in Cytology*, 1937, 399-419.

REVIEWS

Plane and Spherical Trigonometry. By L. M. Kells, W. F. Kern and J. R. Bland. Third Edition. (McGraw-Hill Book Co.), 1951. Pp. 290.

The book is a revised edition of a text-book primarily intended for use in military and naval schools, and in technological institutes. The scope of the subject-matter is adjusted to suit the needs of such institutions, and hence falls slightly short of our usual Intermediate syllabuses. The treatment is lucid and precise. A good number of problems of topical interest to technological students are given and are illustrated by pictures or drawings. These pictures and drawings will certainly stimulate interest in the subject to those who may be apathetic towards mathematics.

There are three chapters on spherical trigonometry, including definitions, solutions of spherical triangles and a brief account of their application to the determination of co-ordinates of celestial bodies.

In Appendix I, an angular unit called the *mil* is introduced, which is equal to 1/6400 of four right angles. This unit has been found convenient in certain military measurements. This was adopted by the Infantry during World War I, and has now become general in military science. The book ends with two Tables—one of four-figure logarithms, and the other of four-figure logarithms of the trigonometric functions.

Our students of the Intermediate classes will doubtless find the book stimulating and useful.

C. N. S.

The River Mathematics. By A. Hooper. (Oliver & Boyd Ltd., Edinburgh and London), 1951. Pp. 370. Price 18 *sh.* 6 d. net.

Mathematics is the river "on which now sail the proud ships of Science, Engineering and Aeronautics", "whose ventures into the unknown offer mankind the possibility of a New World of freedom from want and consequently of freedom from fear. Except for the River Mathematics, these ships could never have been launched; only its never-failing flood keeps them afloat". The river split into two distinct branches, called "Geometry" and "Number Reckoning", millenniums before 2,000 B.C., which were shut off from each other until modern times. Two long tributaries by name "Astronomical Measurement of Angles and Chords, etc." and "Abstract Science of Numbers" on opposite sides of the main river, eventually flowed into it and helped to break down the barrier that for many centuries had kept apart the branches of the main river.

Opening the book with these poetic ideas, the author gives a very neat and lucid account of the development and fundamental ideas of arithmetic, algebra (including logarithms), graphs and co-ordinate geometry, geometry, trigonometry and the calculus. The names of some of the chapters suggest not only the scope of the subject-matter, but also continue the poetic touch in the background of the whole book: Number-Symbols, Bits and Pieces (i.e., fractions), Indicating direction on the Number-Scale, Mathematical Pictures (i.e., graphs), "Earth-Measurement", position of a point on a surface, Building up Formulæ, the Rate of Growth of a Function—the Calculus.

As one of the finest books that can be recommended to the general student who seeks after a clear picture of the fundamental processes of mathematics, the book must find a place on the book-shelf of every general library. To the specialist in mathematics too, the book will furnish a delightful recreation for easy-chair reading or for a railway journey. The teacher of elementary mathematics will certainly profit by the book which should inspire him to make his presentation of the subject lucid and appealing to the common man. The get-up of the book is excellent.

C. N. S.

Molecular Microwave Spectra Tables. By Paul Kisliuk and Charles H. Townes. (National Bureau of Standards, Circular 518), Pp. 127. Price 65 cents. (Copies can be had from Government Printing Office, Washington 25, D.C.)

Although microwave spectroscopy is a subject of recent origin, it has grown considerably during the short period of its existence. The present volume summarising the results obtained so far in tabular form is therefore quite welcome. It is bound to stimulate further research in this field.

The Tables constitute a modernisation and revision of those published in the *Journal of Research of the National Bureau of Standards*, (1950, 44, 611) and include materials published

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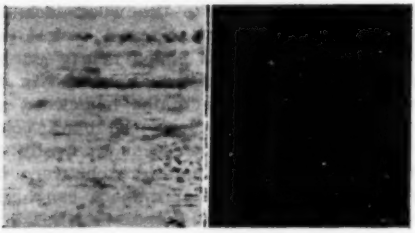

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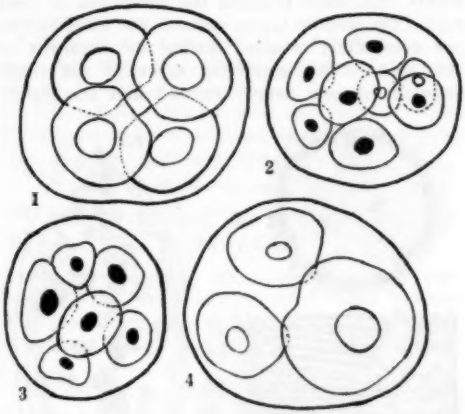

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Mathematics is the river "on which now sail the proud ships of Science, Engineering and Aeronautics", "whose ventures into the unknown offer mankind the possibility of a New World of freedom from want and consequently of freedom from fear. Except for the River Mathematics, these ships could never have been launched; only its never-failing flood keeps them afloat". The river split into two distinct branches, called "Geometry" and "Number Reckoning", millenniums before 2,000 B.C., which were shut off from each other until modern times. Two long tributaries by name "Astronomical Measurement of Angles and Chords, etc." and "Abstract Science of Numbers" on opposite sides of the main river, eventually flowed into it and helped to break down the barrier that for many centuries had kept apart the branches of the main river.

Opening the book with these poetic ideas, the author gives a very neat and lucid account of the development and fundamental ideas of arithmetic, algebra (including logarithms), graphs and co-ordinate geometry, geometry, trigonometry and the calculus. The names of some of the chapters suggest not only the scope of the subject-matter, but also continue the poetic touch in the background of the whole book: Number-Symbols, Bits and Pieces (i.e., fractions), Indicating direction on the Number-Scale, Mathematical Pictures (i.e., graphs), "Earth-Measurement", position of a point on a surface, Building up Formulæ, the Rate of Growth of a Function—the Calculus.

As one of the finest books that can be recommended to the general student who seeks after a clear picture of the fundamental processes of mathematics, the book must find a place on the book-shelf of every general library. To the specialist in mathematics too, the book will furnish a delightful recreation for easy-chair reading or for a railway journey. The teacher of elementary mathematics will certainly profit by the book which should inspire him to make his presentation of the subject lucid and appealing to the common man. The get-up of the book is excellent.

C. N. S.

Molecular Microwave Spectra Tables. By Paul Kisliuk and Charles H. Townes. (National Bureau of Standards, Circular 518), Pp. 127. Price 65 cents. (Copies can be had from Government Printing Office, Washington 25, D.C.)

Although microwave spectroscopy is a subject of recent origin, it has grown considerably during the short period of its existence. The present volume summarising the results obtained so far in tabular form is therefore quite welcome. It is bound to stimulate further research in this field.

The Tables constitute a modernisation and revision of those published in the *Journal of Research of the National Bureau of Standards*, (1950, 44, 611) and include materials published

upto November 15, 1950, and also much unpublished information.

The introduction provides an explanation of the Tables and also a short discussion of microwave spectra and important formulæ. In the Tables are given the frequencies, assignment of quantum numbers, and intensities of about 1,800 microwave absorption lines. They also include the best available values of other pertinent molecular data, such as rotational constants, dipole moments, quadrupole coupling constants, and rotation vibration interaction constants. In addition to listing the frequencies once for each molecule, the circular lists then again in consecutive ascending order of frequency. Only molecular lines of frequency greater than 1,000 megacycles are included. This excludes resonances found by molecular beam techniques rather than the usual microwave absorption measurements, also those of atomic hydrogen and casium that fall in the microwave region. Microwave absorption in paramagnetic gases due to transitions between Zeeman components is not included.

References are given for all the data contained in the Tables. For easy calculation of quadrupole hyperfine structure, a tabulation of Casimir's function is included. An alphabetical list of authors, and lists of molecules by name and by chemical symbol have been included as Appendices.

R. S. K.

Corrosion Testing Procedures. By F. A. Champion. (Chapman & Hall Ltd., London), 1952. 8 vo. Pp. xi + 369, Illustrated.

Considering that corrosion testing procedures are so variable and conditioned so largely by the environment, Dr. Champion deserves to be congratulated on producing this excellent treatise on the subject.

The author has successively dealt with in critical detail the factors governing the selection of test specimens, the several kinds of corrosion media and the various tests that can be conducted both in the laboratory as well as outside. The later chapters deal with the assessment of effects of corrosive attack on the specimens and on the presentation and interpretation of results. The treatment is throughout clear and full although it may appear that the final chapter on the interpretation of results could have been somewhat amplified.

The diagrams of the various apparatus are very clear and helpful. The author has obviously written the book so that the research worker can construct his own apparatus. The exhaustive list of references at each stage will be immensely useful to the research worker. The volume should find a place in every library.

E. G. R.

Chemistry of Carbon Compounds, Vol. I, Part B, Aliphatic Compounds. Edited by E. H. Rodd. (Elsevier Publishing Co., London and New York), 1952. Pp. 779-1462. Price £ 7.

Part A of this volume dealing with 'General Introduction and Aliphatic Compounds' has already been reviewed in this Journal. Part B completes the systematic treatment of aliphatic compounds. There are eleven chapters (Ch. XII to XXIII) covering about 700 pages. Following the prevalent practice, carbohydrates are also included in this part though they exist largely in a cylic form. This class of compounds and their derivatives are treated fully in detail and plenty of references are given. A brief account of the group of ascorbic acids forms part of this treatment. The last two chapters deal with proteins and enzymes, and contain upto-date information on these highly complex and biologically important groups of substances.

Along with the present volume is supplied the errata for Vol. I, Part A. There seems to be need for a similar list for Part B also. For example, on p. 973 the data given about norcaperatic acid are wrong; for it is not a succinic acid derivative, but is a derivative of citric acid. Roccellic acid is not found under succinic acid derivatives and this is a serious omission of a naturally occurring compound.

The special features mentioned in connection with Part A are kept up such as evenness of treatment and references to original sources. Probably more references could be given. An important sugar like L-sorbose does not get the literature reference for its preparation from sorbitol by bacterial oxidation (p. 1259). In books of this nature with limitations of space, it is naturally difficult to pick and choose references very correctly. There is no doubt that the present volume provides a valuable reference book on the portions dealt with.

T. R. S.

Isotopes in Biochemistry—Ciba Foundation Conference. (J. A. Churchill Ltd., London), 1951. Pp. xv + 288. Price 27 *sh.* 6 *d.* net.

Under the auspices of the Ciba Foundation, scientists actively interested in the biological application of isotopes from all over Europe and America, met to discuss the present status of the subject, pool their experiences and smoothen out their technical difficulties. This conference, the tenth of a series sponsored by the Founda-

tion, was distinguished by the fact that the membership was strictly limited to active workers, thereby securing a high level of efficiency of its proceedings. These are presented in the volume under review in six parts: (1) Steroids, (2) Hæmoglobin and metabolic derivatives, (3) Use of tracers in the study of biological effects of radiation, (4) Nucleic acids, (5) Proteins and amino acids, and (6) Carbohydrate and fatty acid metabolism.

Sir Charles Harington in his foreword to the volume has cautioned about the difficulties, complexities and limitations inherent to the tackling of biochemical problems with the aid of isotopes as tracers. In the words of Sir Charles, "All these problems require powers of biochemical interpretation; many of them demand also new work in organic chemistry, both for the synthesis of the specifically labelled precursors whose metabolic fate it is desired to study, and for the stepwise degradation of the biosynthetic product, so that the process of its formation can be analysed. Again new methods of isolation of intermediary metabolites may have to be devised. Thus the full development of the isotope technique in the field can only be achieved with the aid of concurrent advances in the more conventional chemical and biochemical methods."

A study of the volume will show how the views of Sir Charles have been supported by the proceedings of the conference which 'are not only of the greatest intrinsic interest, in so far as they indicate the potentialities of isotope research in biochemistry, but serve as an inspiration for the further cultivation of this productive field of work.

The Enzymes. (*Chemistry and Mechanism of Action*), Vol. II, Part I. Edited by James B. Sumner and Karl Myrbäck. (Academic Press Inc., Publishers, New York), 1951. Pp. ix + 790. Price $ 14.80.

This volume, the third in this monumental series, contains 21 topics contributed some of the top-ranking workers in the field.

A brilliant exposition of the theory of oxidation-reduction by L. Michaelis constitutes the first posthumously published article in the volume. Nathan O. Kaplan discusses the thermodynamics and mechanism of the energy-rich phosphate bond which is of fundamental importance in the promotion and regulation of metabolic reactions. The subject of Transphosphorylating Enzymes of Fermentation, is reviewed by Sidney P. Colowick. The fourth contribution by H. M. Kalcker relates to Dephosphorylation of Adenosine Polyphosphates. Aldolase which has been crystallised from different sources and Isomerase discovered by Meyerhof and Kiessling, have both been described by Meyerhof.

The subject of keto acid decarboxylases has been reviewed by Birgit Vennesland while that of amino acid decarboxylases is treated by Otto Schales. A two-page article on desulfinase is contributed by C. Fromageot who first observed this enzyme in rabbit liver.

The important subject of codehydrogenases and apoenzymes has been comprehensively reviewed by F. Schlenk whose own substantial contribution to this field are well known. The tenth article in this volume on succinic dehydrogenase has also been contributed by Schlenk. Hydrogenase and hydrogenlyase are treated by W. W. Umbreit in the following article.

Hugo Theorell has discussed the topic of Flavine containing enzymes. This is followed by a bunch of three articles on the iron-containing enzymes: on cytochrome by K. G. Paul, on catalases and peroxidases by H. Theorell and on the enzyme substrate compounds by Britton Chance. Copper oxidases which comprise tyrosinase, laccase, other phenolases and ascorbic acid oxidase, have been reviewed by C. R. Dawson and W. B. Tarpley. This is followed by articles on oxidation of amino acids by H. A. Krebs, on Oxidation of Amines by E. A. Zeller and on Lipoxidase by R. T. Holman and Sune Bergström. A highly specialised type of the enzyme system associated with Bioluminescence is described by E. N. Harvey who is the foremost authority on this subject. Oxidation of organic sulphur with special reference to animal metabolism is the subject of a contribution by C. Fromageot. Anaerobic glycolysis, respiration and the closely connected phenomenon of the Pasteur Effect, has been treated by Frank Dickens in an illuminating article. Finally F. F. Nord and his associate Sidney Weiss have contributed a brilliant review on yeast and mold fermentations.

The high standard and brilliance of the contributions has been secured through international collaboration among workers from Denmark, France, England, Sweden and the U.S.A. The Editors of the series deserve to be congratulated on this praiseworthy enterprise.

The Genetics of Garden Plants. By M. B. Crane and W. J. C. Lawrence. (Macmillan & Co., Ltd., London), 1952. Fourth Edition. Pp. xvii + 301. Price 20 *sh.*

This is the revised and amended edition of the standard book on the genetics of garden

plants. The subject of Heterosis is treated in greater detail in this edition and details of genetics of Nemesia, Dianthus and Brassica have been added. The issuing of a fourth edition establishes the well-deserved popularity of this book.

Since a review of any previous edition has not appeared in this journal, the main features of this book may be mentioned. Both the authors are connected with the John Innes Horticultural Institution and have made valuable contributions to plant genetics and pomology. The book is comprehensive in that it deals with the principles of genetics, genic analysis of selected garden plants and fruits of temperate countries, as well as a consideration of origin of new and improved forms. A chapter on the chemical and genetical basis of flower colour needs mention, as this is an interesting line of genetical research deserving attention of all plant geneticists. The major contributions to this subject have been made from the John Innes Institution and this book gives a very good account of it.

Because of the original treatment of the subject, the book is essential to all botanical libraries. As a text-book, however, the book is too advanced for undergraduates, and further the ornamental and fruit plants genetically analysed are not commonly grown in this country.

C. G.

A Guide to Filter-Paper and Cellulose Powder Chromatography. Compiled by J. N. Balston and A. E. Talbot. Edited by T. S. G. Jones. (H. Reeve Angel & Co. Ltd., London, and W. R. Balton Ltd., Maidstone), 1952. Pp. 145. Price 8 *sh.*

This volume represents an extremely useful and welcome treatise on the methods and applications of paper chromatography, which by virtue of its simplicity, elegance, flexibility and extensive and varied applicability, has been attracting the attention of ever-increasing number of scientific investigators. Methods of cellulose powder chromatography are also included in this volume.

The success of this versatile technique depends among other factors, on the excellence, quality and uniformity of the filter-paper employed. It is a source of great satisfaction that Messrs. W. R. Balton Ltd., the famous manufacturers of Whatman Filter-Papers and Cellulose Powders have sponsored the publication of this treatise. They invite comments and criticisms from workers and it is hoped this co-operation will bring out improvements in the quality of the paper. The volume is presented in two parts; the first part deals with methods and materials; the second with applications of the technique.

A highly instructive treatment on the methods of using filter-papers, impurities associated with the materials, choice of paper, specifications of different types of filter-papers, are included in the first part. This part should be carefully read by every one who wishes to avoid serious pitfalls in the practice of this simple technique and obtain reliable and reproducible paper chromatograms.

The second part gives an illuminating survey of the applications of the technique and describes under each section the several modifications introduced. This part contains a great wealth of practical information.

We have no doubt that this most opportune publication with its elegant get-up and modest price, will be received with enthusiasm and gratitude by all workers in this field.

Books Received

Five-Membered Heterocyclic Compounds with Nitrogen and Sulphur or Nitrogen, Sulphur and Oxygen (Except Thiazole). By L. L. Bambas. (Interscience Publishers), 1952. Pp. xi + 403. Price $ 14.00.

Advances in Catalysis, Vol. 4. Edited by W. G. Frankenburg and V. I. Komaressky and E. K. Rideal. (M/s. Academic Press), 1952. Pp. xi + 457. Price $ 9.50.

Annual Epidemiological and Vital Statistics, 1947-49, Part I. W.H.O., (Geneva), 1952. Pp. 746. Price $ 10.00.

The Rational and the Super-rational, Vol. II. By Cassius Jackson Keyser. (M/s Scripta Mathematica), 1952. Pp. viii + 259. Price not given.

Dairying in India. By J. N. Warner. (Macmillan & Co.), 1951. Pp. xii + 380. Price not given.

A Study of Combined Bending and Axial Load in Reinforce Concrete Members. By Eivind Hognested, University of Illinois Engineering Experimental Station), 1951. Pp. 128. Price $ 1.00.

What do We Know about Diagonal Tension and Web Reinforcement in Concrete? By Eivind Hognestad. (University of Illinois Engineering Experimental Station), 1952. Pp. 47. Price $ 0.50.

The Initiation and Growth of Explosions in Liquids and Solids. By F. P. Bowden and A. D. Yoffe. (Cambridge University Press), 1952. Pp. xii + 104. Price 22 *sh.* 6 *d.*

Punched Cards, Their Applications to Science and Industry. Edited by Roberts S. Casey and James W. Perry. (Reinhold Publishing Corporation, New York), 1952. Pp. viii + 506. Price $ 10.00.

Typical Means. By K. Chandrasekharan and S. Minakshisundaram. (Oxford University Press, Madras), 1952. Pp. x + 139. Price Rs. 22-8-0.

SCIENCE NOTES AND NEWS

Ripening of Mangoes

Shri K. Kirpal Singh and Dr. P. B. Mathur, Division of Storage and Preservation, Central Food Technological Research Institute, Mysore, report as follows:

A study of the work so far conducted on the cold storage of mangoes (*e.g.*, Cheema, G. S., Karmarkar, D. V., and Joshi, B. M., *Ind. Jour. Agric. Sci.* 1950, **20**, 259 and Wardlaw, C. W. Low Temperature Research Station, Trinidad, *Memoir No.* 7, 1937) gives the impression that mangoes can be ripened satisfactorily at any temperature ranging from 60° F. to room temperature. An investigation conducted at Mysore has shown that the ripening of mangoes at 67-70° F. has several important advantages over the usual method of ripening at the room temperatures, such as, an increase in the percentage of total soluble solids and a lesser decrease in acidity and a better sugar-acid blend. Recognition of the fact that there is an optimum temperature for mango ripening will not only curtail the wastage incurred otherwise but will also provide better ripened fruits. Details in connection with these experiments will be reported elsewhere. Our thanks are due to Dr. V. Subrahmanyan, Director, for his keen interest in these investigations.

Damage to Pulses from *Bruchid* Pests

Shri Snehamoy Chatterjee, Indian Agricultural Research Institute, New Delhi, writes that as a result of laboratory experiments, it was found that the damage to stored pulses and net loss in weight from *Bruchid* pests is more under lighted condition of storage than under dark condition. The damage was also more in ventilated sets than in air-tight ones in both the lighted and dark conditions. Therefore, in order to have the minimum loss of the grains, pulses may have to be stored in opaque receptacles or in dark condition of storage and the purpose would still be better served if the grains are stored in air-tight containers.

Grateful thanks are due to Dr. E. S. Narayanan for guidance in this work.

Rain Making with Common Salt

Dr. D. A. Davies, Director, East African Meteorological Department, Nairobi, reports that trials are being made this season, in conjunction with the Overseas Food Corporation, with a mixture of 90 per cent. sea-salt and 10 per cent. calcium chloride, ground to 5-100 micron particle size. Canisters holding 15 g. of this powder are being borne aloft by balloons and dispersed at the base of cumulus clouds by 1½ g. charges of gunpowder exploded by time-fuses.

The scientific hypothesis underlying the experiment is that silver iodide, now the agent most generally used to cause precipitation, is effective only at several degrees below freezing point. In the tropics, however, rain is found sometimes to fall from clouds at temperatures above the freezing point. Dr. Davies hopes that the hygroscopic materials now being tried will produce large water drops which, in their fall, will grow by collision, split and repeat the process in a chain reaction—an idea suggested by F. H. Ludlam. The materials would also be very cheap and plentiful.

Preservation of Wild Life

A Central Board for Wild Life has been set up in India under the Ministry of Food and Agriculture. It is charged with supervising the maintenance of India's valuable fauna, of which several species, including the Asiatic lion, the one-horned rhinoceros, the tragopan and the cheetah, are in danger of becoming extinct. Other duties of the Central Board are to encourage the creation of reserves and national parks, to advise the authorities on measures necessary for conservation, and to undertake education in the field of nature protection. The President of the Central Board for Wild Life is H. H. the Maharajah of Mysore.

Study of Penicillin Technology

Dr. G. Sankaran, Officer-in-charge, Indian Penicillin Committee, Bombay and Dr. K. Ganapathi, Assistant Director, Haffkine Institute,

Bombay, have been deputed to Switzerland and U.S.A. for a period of six months for training in penicillin technology on a W.H.O. Fellowship.

New Uranium Detector

A new detection device that locates uranium much faster and more accurately than the Geiger counter has been developed by the Atomic Energy Commission of the U.S.A. The probe is said to be accurate almost to an inch measuring the depth of ore strata. It is also much more sensitive to smaller deposits of metal and indicates varying energy impulses, thus identifying elements.

Development Fund for India

The Norwegian Parliament has voted £ 500,000 for the Fund and a national campaign is being organised to raise another £ 500,000 by voluntary contributions. The Fund is intended chiefly to give technical and economic assistance to a development area in India, not yet specified. Dr. U. S. Sverdrup, Director of the Norwegian Polar Institute, has been appointed Chairman of the Fund.

Quartz Paper as Insulator

A new quartz paper announced by a firm in Ohio is said to resist temperatures upto 3,000° F., which is more than the temperature limit of asbestos. It has also been found to be an effective insulator for high frequency circuits.

Harvests from the Desert

The Aral Experimental Station established 19 years ago in the U.S.S.R. has developed effective measures of cultivating farm crops on sandy soil in the semi-desert regions, thus exploding the current view regarding their lack of fertility. These new methods are based on the careful conservation of winter moisture accumulated in the soil; conservancy fallowing of the soil by planting sorghum, which ensures the accumulation of a winter snow covering of up to two or three feet; and planting crops in wide rows with a reduced quantity of seed to the acre. The station has also developed advanced methods of irrigation for this zone, based on the travepolye system of crop rotation. These methods make for higher fertility of the soil, prevent resalination and ensure high yields.

UNESCO Subventions for Scientific Conferences

A Report published by the UNESCO indicates the large extent to which various international non-governmental organisations ranging from the International Union of Pure and Applied Physics to the Institute of Oceanography and the International Union for the Protection of Nature have received financial support from the UNESCO both in regard to their regular activities and in particular for convening conferences and holding symposia. Notable among these activities was the conference on Nuclear Physics held in Copenhagen in July, 1951.

IMPORTANT NOTICE

In view of the transfer of the Editor to Madras, it is requested that all articles, letters, reviews, books for review, exchange journals, corrected proofs and other items intended for publication in CURRENT SCIENCE may kindly be addressed to:

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Guindy, Madras-25.

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